

# The Southern Surgeon

Subscription in the United States, \$8.00

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Vol. XVI, No. 5

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May, 1950

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## SOME PHASES OF GALLBLADDER AND DUCT DISEASE

R. L. SANDERS, M.D.

Memphis

**T**HOSE phases of gallbladder and duct disease with which we are concerned herein are benign lesions of a surgical nature. Since the pathologic process often involves both the gallbladder and the ducts, the surgical considerations in diseases of the two structures are obviously closely related.

*Chronic Cholecystitis.* Experience has materially narrowed our concept of the indications for removal of the chronically diseased gallbladder. Assuming that it has been definitely determined that a patient has chronic cholecystitis and that his symptoms are attributable, at least primarily, to this condition, the question of operative intervention rests largely upon the presence or absence of stones. We do not, as a rule, recommend surgery for patients with chronic noncalculous cholecystitis, having found that the results are often disappointing. Probably an average of 35 per cent of patients who have a cholecystectomy for a noncalculous gallbladder are troubled with biliary dyskinesia postoperatively. The symptoms may at times be produced by overlooked duct stones, associated pancreatitis, hepatitis or cholangitis, adhesions, or an inflammation or other lesion of the cystic duct remnant. More often, however, they are due to removal of the gallbladder on no other basis than the demonstration of poor function. Although the poor function may arise from a disturbance of the sphincteric mechanism, the underlying cause will probably be found in a neurogenic disorder, some abnormal constitutional state, or an organic lesion outside the gallbladder.

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Read before the first annual Postgraduate Surgical Assembly of The Southwestern Surgical Congress, Sept. 27, 1949.

When, however, a total loss of gallbladder function is demonstrated and is associated with clear-cut, severe and persistent symptoms, if jaundice is present or the patient gives a history of jaundice, if duodenal drainage reveals an abnormal concentration of bile, or if complications referable to the pancreas or liver are associated, then one may feel justified in removing the gallbladder even though no stones are shown in the roentgenogram. Not infrequently in such cases, stones will be found filling the gallbladder or obstructing the duct, or both.

In any case, the presence of gallstones is itself ample indication for cholecystectomy. This is true although the patient has little symptomatic evidence of cholecystitis and the function of the gallbladder is essentially normal. Moreover, the earlier operation is performed, the better. The high percentage of perforations from stones and the corresponding high mortality is a familiar story to abdominal surgeons. In 1072 gallbladder operations performed for benign disease during the past seventeen years, we have found perforations in 8 per cent, of which 88 per cent were associated with stones (Table I).

TABLE I.

PERFORATIONS AND MORTALITY IN 1072 OPERATIONS FOR CHOLECYSTITIS

	<i>Mortality</i>
Total gallbladder operations.....1072	32 (3%)
Perforations ..... 86 (8%)	11 (13%)
(With stones.....76 (88% of 86))	

The 11 fatalities in the above group of perforations constitute more than one third the fatalities in the entire 1072 cases.

Another possibility to be borne in mind is that of malignancy. According to Finney and Johnson, between 4 and 5 per cent of all calculous gallbladders may be associated with carcinoma of that organ. This is higher than the mortality rate of cholecystectomy for chronic cholecystitis.

Added to these indications for early cholecystectomy in the presence of gallstones is the menace of serious injury to the liver by prolonged interference with the drainage of bile. If the gallbladder is removed early, the diseased portion will regenerate. The longer the obstruction persists, the greater the liver damage and the less the likelihood of repair. Similarly, the pancreas may be so affected that its function is materially altered. We have observed varying degrees of pancreatitis in a high percentage of our cases, in some

being so acute as to overshadow the gallbladder disease. The local and systemic effects of these complications not only impair the patient's resistance to surgery, but add to the difficulty of the operation, increase the mortality, prolong convalescence and even permanently affect the patient's general health.

*Acute Cholecystitis.* One of the strongest arguments in favor of early operation in cholecystitis with stones is found in the large number of cases wherein the stones precipitate an acute attack by occlusion of the cystic duct. We have found stones in 84 per cent of our acute cases. In a few, however, the acute symptoms are brought about by angulation of the duct or other causes. In the absence of a mechanical obstruction, present opinion is largely in favor of a chemical factor in the production of the acute process. This chemical reaction may be due to a reflux of pancreatic secretion into the gallbladder, though in the majority of cases a concentration of bile salts in the gallbladder is probably responsible. The non-infectious nature of the process is demonstrated by the fact that cultures from such lesions show no evidence of infectious organisms. In support of this theory, Gatch and Battersby call attention to the fact that cholecystitis is rare in children, though infections are more prevalent in children than in adults and, further, that abdominal wounds rarely become infected following operations for acute cholecystitis. It would seem from this that many cases of acute cholecystitis which subside under treatment are of chemical origin. Obviously, however, an infection may develop in a gallbladder damaged by the toxic effect of the chemical disturbance.

The most opportune time for removal of the acute gallbladder apparently is still not well understood. In my opinion, there are four indications for surgery in acute cholecystitis: (1) sustained pain, i.e., pain which fails to subside or increases within 24 to 48 hours after the onset of the attack; (2) the persistence of a palpable, tender mass in the right upper quadrant and abdominal rigidity; (3) a systemic reaction characterized by an elevation of temperature and a rising leukocyte count, and (4) lack of clinical improvement despite the use of supportive therapy. Especially are sustained pain and a tender mass positive indications. In some patients, particularly those in poor general condition, operation may be delayed as long as 72 hours unless meanwhile the attack appears to increase in severity. In any case, if the symptoms and signs show no evidence of abatement within 48 to 72 hours, operation is advisable. Further delay is not only dangerous to life, but the edema of the tissues will make identification of the structures difficult and add to the operative risk.

A summary of our experience with surgical cholecystitis during the past seventeen years is shown in Table II.

TABLE II.  
FINDINGS AND MORTALITY IN 1072 OPERATIONS FOR CHOLECYSTITIS

	<i>Number</i>	<i>Stones</i>	<i>Perforations</i>	<i>Mortality</i>
Chronic	716 (66.9%)	439 (61% of 716)	31 (4.3% of 716)	16 (2.2%)
Subacute	188 (17.5%)	146 (78% of 188)	21 (11% of 188)	4 (2%)
Acute	168 (15.6%)	142 (84.4% of 168)	34 (20% of 168)	12 (7%)
	1072 (100%)	732 (68.3% of 1072)	86 (8% of 1072)	32 (3%)

Of the 1072 cases, stones were present in 732, or 68 per cent. Over the years, as we have limited our criteria for cholecystectomy, we have found a gradually increasing number of gallstones; for the past three years, stones have been recovered in 87 per cent of our gallbladder operations.

It will be observed that 168, or 15.6 per cent, of the operations were for acute cholecystitis, and in 34, or 20 per cent of the 168, perforation had developed. The mortality of 12 constitutes 7 per cent of the 168.

The mortality rate in the entire group provides impressive evidence of the danger of delayed operation in these cases. As previously pointed out, of the 32 deaths, 11 (34 per cent) followed operations for perforated gallbladders. Four fatalities were in cases of acute cholecystitis without perforation; in 3 of the 4, stones were present. In 4 other fatal cases, the operation was secondary to one or more previous surgical procedures on the gallbladder and ducts. In 6 additional cases, the gallbladder operation was combined with some type of operation upon the stomach for ulcer or malignancy. Of the remaining 7 patients, 4 had both gallbladder and duct stones, necessitating choledochotomy, another had a choledochotomy because of jaundice associated with gallstones, one had severe hepatitis, and the other died following a second operation for intestinal obstruction. In all of the 32 cases, except perhaps the last and the 6 wherein a stomach operation was performed, some complication was present which was attributable to a long-standing disease.

*Lesions of the Ducts.* Because of the frequent association of duct obstruction with cholecystitis and its damaging effect upon the liver function, the question of opening the ducts is often a consideration in operations upon the gallbladder. As is well known, obstructions necessitating choledochotomy may arise from stricture, carcinoma of the duct or pancreas, pancreatitis, or other abnormalities, though



the vast majority are produced by a stone or stones. We have opened the ducts in 17 per cent of our operations for benign gallbladder and duct disease and have found duct stones in 73.5 per cent of the choledochotomies.

Our criteria for choledochotomy have been as follows:

1. Palpation of a stone.
2. Abnormal dilatation of the ducts.
3. Jaundice or a history of jaundice, especially if associated with chills and fever or with gallstone colic.
4. A contracted gallbladder.
5. Multiple small stones in the gallbladder with an enlarged, patent cystic duct.
6. Flocculent bile in the duct.

The palpation of a stone may at times be difficult, especially if the duct is excessively dilated. Moreover, one should take care not to mistake an enlarged gland for a stone in the duct.

In all operations for cholecystitis, it is our custom to examine the ducts visually as well as by palpation, unless the process is too acute and edema too extensive. Thus far, we have found the common or hepatic duct, or both, dilated in almost 80 per cent. Clearly, an abnormal enlargement of the duct is not alone sufficient reason for choledochotomy. Not infrequently, the abnormal dilatation is produced by occlusion of the cystic duct with a stone in long-standing cholecystitis, the duct having taken over the function of the gallbladder. In other cases, it is due to extrinsic mechanical obstruction, and in still others is secondary to a gallbladder infection and is amenable to relief by cholecystectomy alone.

Jaundice, likewise, is an unreliable sign of stone. Past or present jaundice was a finding in only 50 per cent of our cases wherein duct stones were recovered. Jaundice or a history of jaundice was a factor in 86 per cent of the remaining choledochotomies, and in approximately half of these the duct was dilated because of an associated pancreatitis. Occasionally, also, we have opened a dilated duct because of jaundice, only to find no explanation for the obstruction other than a possible spasm of the sphincter of Oddi.

When one encounters a gallbladder no larger than the thumb, one may be sure of a long-standing disease. Even though the organ does not contain stones, they will probably be found in the ducts. Again, in the presence of multiple stones in the gallbladder and an enlarged, patent cystic duct, it is more than likely that small stones will have passed into the common duct. Cloudy, flocculent bile, as

determined by aspiration, likewise suggests an occlusion of the distal end of the duct by a stone.

For the purpose of comparing the incidence of gallbladder and duct stones in our earlier and recent cases, we have divided the 1072 operations comprising this study into two groups. The first group, containing 500 cases, includes those performed between Jan. 1, 1932, and Jan. 1, 1939. The second group, consisting of 572 cases, represents those operations performed between Jan. 1, 1939, and Aug. 1, 1949 (Table III).

TABLE III.  
INCIDENCE OF STONES IN 1072 OPERATIONS ON THE GALLBLADDER  
AND DUCTS

	<i>Gallstones</i>	<i>Cholelithotomies</i>	<i>Duct Stones</i>
Group I. 500 gallbladder operations 1-1-32—1-1-39	268 (53.6%)	56 (11% of 500)	40 (70% of 56)
Group II. 572 gallbladder operations 1-1-39—8-1-49	464 (81%)	117 (20% of 572)	89 (76% of 117)
	732 (68%)*	172 (16% of 1072)	129 (75% of 172)

\*During the past 3 years, gallstones have been found in 87 per cent of the gallbladder operations.

It will be seen that the percentage of both the choledochotomies and the number of cases in which duct stones were recovered has increased within recent years. Similarly, the percentage of gallstones is materially higher in the last group, and has increased still further during the past few years.

In this connection, I should like to point out the advisability of removing the gallbladder before the duct is opened. In two cases, we have found it necessary to irrigate the duct a second time after a choledochotomy performed prior to cholecystectomy. The gallbladder in both cases had contained stones, and during its manipulation in removal, a few of the stones had escaped through the cystic duct into the common duct. Since these experiences, we have removed the gallbladder before doing the choledochotomy, that we may be practically certain the ducts are free of stones at the conclusion of the operation.

An abnormal dilatation of the duct arising from simple stricture at the distal end usually calls for additional surgery to sidetrack the bile into the intestine. Even though the stricture may be incomplete, it is difficult to dilate the end of the duct sufficiently at the time of choledochotomy to insure continuous and ample drainage. More-

over, the dilated area tends to contract again and bring about another impediment to the flow of bile. This leads to a recurrence of the same pathologic condition, the original clinical picture is reproduced, and a second operation becomes necessary.

We have been impressed with the results of choledochoduodenostomy, when feasible, as a means of relieving the obstruction in these cases. The procedure is not only comparatively easy from the technical standpoint, but is physiologic in principle and thus offers a wide margin of safety. All the bile is immediately made available in that part of the intestine where it normally empties, and intestinal function is soon restored. The first requisite to the operation is sufficient dilatation of the duct to permit a large stoma. By incision of both the duct and the duodenum in the longitudinal direction and side to side anastomosis, the stoma may be made of adequate length to preclude contraction; thus, stricture and obstruction are unlikely and bile drainage remains free and constant.

Choledochoduodenostomy is especially preferable to cholecystoenterostomy in the presence of infection. The gallbladder is a poor conductor of bile, and the infectious process induced by chronic bile stasis cannot be relied upon to become quiescent and remain so. If the infection and inflammation persist, the walls become thickened, closing the stoma and leading to a recurrence of the biliary obstruction. For the same reason, one cannot depend upon the continued patency of the cystic duct in such cases. By eliminating the gallbladder, emptying the common duct, then uniting it to the duodenum, one has every assurance of the free passage of bile into the intestinal tract.

Fortunately, choledochoduodenostomy is not only applicable to many benign lesions, but also to many malignancies of the ducts and pancreas. In these, in addition to being sufficiently large to permit an adequate stoma, the duct must be of ample length above the obstruction to permit anastomosis without tension, or one must be able to mobilize the duodenum to a sufficient degree. If the duct is not enlarged and the condition of the gallbladder and cystic duct while the gallbladder is not diseased, the common duct is not appreciable, cholecystojejunostomy is preferable. The latter procedure is usually more suitable for malignancies of the head of the pancreas considerably enlarged, and the cystic duct is patent. When the gallbladder has been removed, however, or when it is not suitable, choledochoduodenostomy is obviously one's only recourse.

Not one of our patients for whom choledochoduodenostomy has been performed has had any postoperative disturbance indicating an ascending infection. Several years after the operation, we have

given opaque media by mouth, placed the patient in the Trendelenberg position, and demonstrated the free reflux of the material through the anastomosis back into the biliary tree. We base these results upon the fact that the side to side anastomosis of the enlarged duct to the intestine permits one to make the stoma of ample proportions to prevent any interference with the flow of bile. The ultimate success of the operation, therefore, depends primarily upon the size of the anastomosis.

#### COMMENT

In concluding this discussion, I should like to emphasize two points, both of which have been mentioned time and again, yet seem still to be well worth repetition. First, when indicated, the gallbladder should be removed before serious local complications and damage to other structures takes place. Acute cholecystitis, perforation and malignancies of the gallbladder, and strictures of the distal end of the duct are the result of long-standing disease. In addition to their permanent systemic effects, they increase the difficulty and dangers of the operation and, directly or indirectly, are responsible for the vast majority of postoperative deaths.

Second, in removing the gallbladder, every precaution should be exercised to avoid injury to the ducts. Trauma during operations upon the gallbladder is responsible for a large number of benign duct strictures. Wide exposure, definite identification of the ducts and vessels, and meticulous care in the use of clamps, the placement of ligatures and in otherwise handling the tissues would eliminate these tragic sequelae of cholecystectomy. Further, when one is confronted with technical difficulties, the structures may be more easily identified by removal of the gallbladder from above downward. If edema and inflammation are too extensive to permit proper identification, one should be content merely to drain the gallbladder and wait until a more advantageous time for its removal.

The solution to by far the majority of gallbladder and duct problems lies in the observance of these precautions.

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## DEATHS FOLLOWING VAGOTOMY

R. W. POSTLETHWAIT, M.D.\*

Charleston, S. C.

H. H. BRADSHAW, M.D.

Winston-Salem, N. C.

CONSIDERABLE interest has developed in vagotomy for the treatment of peptic ulcer since the reports of Dragstedt,<sup>1</sup> of Grimson<sup>2</sup> and of Moore<sup>3</sup> and their co-workers. Physiologic changes, complications and early results after vagotomy have been reported mainly from the clinics of these investigators. In 1946, Weeks, Ryan and Van Hoy<sup>4</sup> reported two deaths following vagotomy. One patient died of peritonitis following perforated ulcer. The absence of the usual symptoms and signs of peritonitis was commented upon by the authors. At the North Carolina Baptist Hospital a somewhat similar death followed an intra-abdominal catastrophe in which the pain, tenderness and rigidity usually associated with peritonitis were not present. Knowledge of these two deaths led to an interest in deaths following vagotomy; for, if such masking of symptoms and signs occurs frequently, then it behooves all surgeons performing vagotomy to be alert to this possibility. On this basis a survey was made to collect summaries on all patients who died following vagotomy for peptic ulcer.

Two hundred sixty-six cards were sent to a selected list of physicians who were known to be interested in vagotomy and 201 cards were returned. From this group and from the literature, 3,678 vagotomies were collected and from these two sources abstracts of the case records on 77 patients who died after vagotomy obtained. These represent deaths at any time after vagotomy and from any cause.

Before discussing these deaths, the following should be emphasized: (1) The summaries and comments should not be interpreted as being critical in any sense of the word. The selection of the patient for operation, of the operative procedure, of the anesthesia, and the preoperative and postoperative care are assumed to be in accord with the current concepts of good surgical judgment and practice unless otherwise noted by the reporting surgeon. (2) The great difficulty of interpreting properly summaries from other clinics is immediately admitted and recognized. In many instances, the

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From the Department of Surgery, Bowman-Gray School of Medicine of Wake Forest College, Winston-Salem, North Carolina.

Read before the seventeenth annual Postgraduate Surgical Assembly of The South-eastern Surgical Congress, Biloxi, Miss., May 23-26, 1949.

summaries were extremely detailed, whereas in others only a sentence or two was obtained. Nevertheless, as only the stated facts are used as a basis for classification and discussion, the conclusions should carry some weight. It is understood that in order to interpret with exactness all factors concerning any particular patient, one must personally follow his clinical course. (3) The classification of the deaths used is an arbitrary one but appears well suited for purposes of interpretation and discussion.

The deaths divided into two groups: (A) operative and (B) late. The operative group included all deaths during the period of hospitalization in which vagotomy was carried out. The late deaths were those after discharge from the hospital, either at home or after readmission. Four sub-groups were established in each main division as follows:

- |                                      |                                    |
|--------------------------------------|------------------------------------|
| A-1. Death due to vagotomy           | B-1. Death due to vagotomy         |
| 2. Death due to ulcer                | 2. Death due to ulcer              |
| 3. Death due to operation directly   | 3. Death due to error in diagnosis |
| 4. Death due to operation indirectly | 4. Death due to unrelated causes   |

Most of the deaths fitted fairly clearly into one or the other of the sub-groups, although occasionally exact classification was in some doubt. In each such case all factors involved were evaluated as carefully as possible, attempting to determine the most proximate cause of death. An example of the difficulties in classification were the three patients who died of aspiration pneumonia. In the first two instances, Cases 7 and 8, the gastric retention following vagotomy was the proximate cause of death, so these cases were classified as death due to vagotomy. Case 23, in addition to aspiration pneumonia, had a bleeding ulcer and arteriosclerosis, particularly coronary sclerosis, which were very definite and important contributory causes of death. Therefore, the latter was classified as death due to operation directly.

*Sub-group A-1: Deaths due to Vagotomy.* Eight deaths were classified as being due directly to the vagotomy.

CASE 1. A white male of unstated age had ulcer symptoms of 10 years' duration with closure of a perforated duodenal ulcer one year prior to admission. X-ray showed a duodenal ulcer. Under cyclopropane anesthesia with endotracheal positive pressure, a left thoracotomy was performed. Two per cent novocaine was injected about the vagus nerves, following which the vagi were resected. The operation was uneventful. The wound was closed and about 15 minutes later, after removing the endotracheal catheter, the anesthetist was aspirating the trachea when the patient suddenly coughed, showed violent convulsive reaction and the pulse became imperceptible. The patient was immediately given .3 mg. atropine and artificial respiration was initiated. The chest was reopened and the heart found to be quiet and dilated



TABLE I  
GROUP A-1. DEATH DUE TO VAGOTOMY

No.	Age	Obs.	Hem.	Route	Vagotomy Plus Following	P.O.		Autopsy	Cause of Death
						Day	0		
1	?	0	0	T	None	0	Yes		Cardiac Arrest: Cerebral Anoxia: ?Vagal Reflex
2	55	0	0	T	None	0	No		Cardiac Arrest: ?Vagal Reflex
3	42	0	0	A	Gastric Resection	0	Yes		Respiratory and Cardiac Arrest: ?Vagal Reflex
4	40	0	0	A	Esophago-Gastrostomy	6	Yes		Laceration of Esophagus, Mediastinitis and Pyothorax
5	52	0	++	A	None	3	Yes		Laceration of Esophagus, Empyema and Peritonitis
6	63	+	0	A	Gastroenterostomy	5	No		Laceration of Esophagus, Secondary Infection
7	56	0	0	T	None	18	No		Aspiration Pneumonia
8	40	0	0	A	Gastrostomy: Gastroenterostomy	9	Yes		Aspiration Pneumonia: Chemical Imbalance

In this and subsequent tables, abbreviations are: Obs.—obstruction, and Hem.—hemorrhage, graded on the basis of 0 to 4 plus. Under route T—trans-thoracic, and A—subdiaphragmatic. P, O, day is the postoperative day of death.

with loss of tone. With cardiac massage and intravenous digitalization ventricular fibrillation occurred. Intracardiac injection of novocaine was performed and the fibrillation ceased. Shortly thereafter, a regular strong beat began, followed by resumption of respiration. The cardiac rate gradually increased to 90 and the blood pressure to 90/70. The wound was closed and the patient was sent to his room. About six hours later, the blood pressure was 130/90. Despite continuous supportive therapy, he gradually failed and expired nine hours after operation. Autopsy showed a chronic duodenal ulcer and massive atelectasis of the left lung.

CASE 2. A 55 year old white man had had symptoms of ulcer for about 9 years. Left thoracotomy was performed under an unstated type of anesthesia. As the right vagus nerve was dissected out, bradycardia resulted and the upper portion of the nerve was injected with one per cent novocaine. The section of the nerve was then removed. A few minutes later the pulse had slowed to between 60 and 70 and shortly thereafter the anesthetist stated she was having difficulty with the patient's respiration. All manipulations were halted and it was then noted that the pulse had become imperceptible. The heart beat was found to be absent, whereupon cardiac massage was begun; .6 mg. of atropine was administered intravenously with a return of heart action. The contractions, however, again became feeble and irregular. Despite intravenous novocaine, repeated doses of atropine and finally intracardiac epinephrine, cardiac contractions could not be re-established over a period of an hour and a half. No autopsy could be obtained.

CASE 3. A 42 year old male had ulcer symptoms for about six months which did not respond to medical treatment. Under cyclopropane and oxygen anesthesia, the abdomen was opened. A scarred area thought to represent healed duodenal ulcer was found just beyond the pylorus. Subtotal gastric resection with gastrotomy and subdiaphragmatic vagotomy were carried out. No untoward results occurred during operation except a transient fall in blood pressure while exerting traction on the stomach to expose the vagi. The patient left the operating room in good condition, his blood pressure 150/80. While he was being transferred from his stretcher to the bed, respiratory difficulty occurred and he expired shortly afterward despite intubation and forced breathing. Autopsy showed no definite cause of death. There was collapse of the right lower lobe of the lung but no bleeding or pulmonary embolus.

These three cases are recorded in detail because of the questionable cause of death in that they were most likely due to some type of vagal reflex. This is a rather poorly understood and apparently complex reaction. Two of the three cases had cyclopropane anesthesia. The type of anesthesia was not stated in the third case. The effects on the heart of cyclopropane are well known. In the second and third cases, definite cardiovascular alterations on manipulation of the vagi occurred; in the second represented by the bradycardia, and in the third by a fall in blood pressure. In the first case the sudden change occurred during tracheal aspiration with a catheter and this irritation may have set up an impulse in a sensitized reflex system. Whereas the deaths cannot definitely be ascribed to a vagal reflex in that the cardiac arrest did not occur with the manipulation,

nevertheless, the relationship seems to be so close that the vagotomy should be called the proximate cause of death.

CASE 6. A 63 year old male had had closure of a perforated duodenal ulcer in 1924 followed by an asymptomatic period of 15 years. For 8 years there had been increasingly more severe ulcer symptoms and for three months vomiting had occurred after meals. X-ray showed a duodenal ulcer with 30 per cent 6 hour gastric retention. Subdiaphragmatic vagotomy and gastroenterostomy were carried out. Twelve hours following operation, subcutaneous emphysema was noted over the left side of the chest and abdomen. X-ray of the abdomen showed pneumoperitoneum. Re-operation was carried out and a perforation of the anterior wall of the esophagus was closed. He appeared to improve slowly but then became worse and expired on the fifth postoperative day. No autopsy was obtained. It was felt by the surgeon that the most probable cause of death was infection secondary to the perforation of the esophagus.

Three such deaths occurred and these should be attributed to the vagotomy directly. In one case, during subdiaphragmatic vagotomy the esophagus was completely divided during elevation of the esophagus in search for missed fibers. The proximal end of the esophagus retracted into the mediastinum, necessitating thoracotomy. In the second case an empyema developed on the left side with inflammatory involvement of the lesser peritoneal sac. At autopsy the pathologist was unable to demonstrate the point of leakage although it was thought that this was the most likely cause of the infection. In the third case, noted in detail above, no doubt of the laceration existed although autopsy could not be obtained to establish the extent of the infection.

CASE 8. A 40 year old man had had ulcer symptoms for 15 years during which time three perforations had occurred, the last resulting in the final hospital admission. Recovery after suture of this perforation was essentially uneventful. He was found to have rather marked anemia and hypoproteinemia which were corrected. Hyperacidity with a large night volume secretion was present. The x-ray showed a duodenal ulcer. Subdiaphragmatic vagotomy, anterior gastrojejunostomy and Witzel gastrostomy were carried out. The patient would not tolerate an inlying nasal tube so that vomiting began on the second day. The surgeon stated that "chloride loss was not adequately compensated." The gastrostomy failed to function and jejunostomy was performed on the ninth day. The patient continued to do poorly, aspirated vomitus and expired. Autopsy showed a healing duodenal ulcer, patent gastrojejunostomy, recent jejunostomy and pulmonary congestion with the bronchi containing fluid similar to that in the stomach.

Two deaths were attributed to aspiration pneumonia in this group. In the second case, autopsy was not obtained so that definite proof was lacking. However, he also had symptoms of severe gastric retention and would not leave the suction tube in place. The degree of gastric retention which may occur following vagotomy has been

TABLE II  
GROUP A-2. DEATH DUE TO ULCER

No.	Age	Obs.	Hem.	Route	Vagotomy Plus Following	P.O.		Cause of Death
						Day	Autopsy	
9	47	0	++	T	Sympathectomy	28	Yes	Perforated Ulcer and Peritonitis
10	?	0	+++++	A	Gastroenterostomy	0	Yes	Bleeding Ulcer
11	?	+++++	0	A	Gastroenterostomy	42	Yes	Starvation and Chemical Imbalance
12	?	++++	0	T	None	90	No	Starvation and Exhaustion

TABLE III  
GROUP A-3. DEATH DUE TO OPERATION DIRECTLY

No.	Age	Obs.	Hem.	Route	Vagotomy Plus Following	P.O.		Cause of Death
						Day	Autopsy	
13	56	0	0	A	Gastroenterostomy: Closure Disruption	5	No	Peritonitis Following Dehiscence
14	43	0	0	A	Gastric Resection	10	Yes	Peritonitis: Leakage of Duodenal Stump
15	?	?	?	A	Gastroenterostomy Jejunostomy	?	?	Peritonitis Following Jejunostomy
16	55	0	0	T&A	Pyloroplasty	19	Yes	Peritonitis and Massive Hemorrhage

TABLE III (Continued)

No.	Age	Obs.	Hem.	Route	Vagotomy Plus Following	P.O.		Cause of Death
						Day	Autopsy	
17	?	+	+	A	Pyloroplasty	18	Yes	Peritonitis: Leakage of Suture Line and Perforated Ulcer
18	?	?	?	A	None	28	?	Peritonitis: Perforation in Volvused Jejunal Loop
19	51	++	0	A	Gastric Resection	12	Yes	Peritonitis: Perforation of Stomach
20	?	?	?	A	Gastroenterostomy	14	Yes	Subdiaphragmatic Abscess
21	33	0	+++	A	Gastric Resection	1	Yes	Postoperative Hemorrhage
22	?	?	?	A	Gastroenterostomy	2	No	Shock—Cause?
23	65	0	+++	A	Gastroenterostomy, Gastrostomy, Ligation Bleeding Vessels and Closure Disruption	11	Yes	Aspiration Pneumonia, Bleeding Ulcer and Coronary Sclerosis
24	60	?	?	A	Excision of Ulcer, Pyloroplasty and Cholecystectomy	1	No	Cerebral Vascular Accident
25	54	?	?	A	Gastroenterostomy and Repair of Large Incisional Hernia	2	No	Cerebral Vascular Accident
26	45	++	0	T	None	30	No	Cerebral Vascular Accident
27	39	?	?	A	None	0	Yes	Coronary Occlusion

described in nearly all the communications on this subject. As much as 4,000 cubic centimeters of fluid has been aspirated on the third or fourth day following operation. With this large volume of retained secretion in a patient already weakened by a major operative procedure, aspiration might readily take place. Dragstedt has emphasized the necessity of keeping the stomach deflated during the early postoperative period.

*Sub-group A-2: Deaths due to Ulcer.* Four patients were classified in this sub-group. The first patient had hypertension in addition to the ulcer. At the time of the transthoracic vagotomy, thoracolumbar sympathectomy was also carried out and 13 days later a right thoracolumbar sympathectomy. Fifteen days later, or 28 days after vagotomy, he expired, and autopsy showed a perforated ulcer with generalized peritonitis. This death will be discussed in detail later. The second case was a patient with massive hemorrhage from a duodenal ulcer who had a subdiaphragmatic vagotomy and posterior gastroenterostomy. Marked technical difficulties were experienced at operation, and the bleeding was obviously continuing. Despite transfusions, he expired as the wound was closed. The vagotomy was only an incidental procedure. The third patient was a dementia praecox patient who went into a marked manic state during the second week after operation and any cooperation was impossible. Despite repeated attempts at supportive therapy, he expired of starvation and chemical imbalance during the sixth week. This death was in no way associated with the vagotomy; the fatality was attributed to the ulcer, although his manic state was the deciding factor in his recovery or death. In the fourth patient after transthoracic vagotomy an empyema developed which responded well to tube drainage. However, the patient took very little food and had repeated episodes of vomiting and diarrhea. Despite jejunostomy and all supportive measures, he progressively became weaker and expired three months after operation. It was the opinion of the surgeon that "it seems unfair to consider this patient's death as due to vagotomy as it was the consensus of those who saw the patient that he was retrogressing steadily and that his chances of surviving for long were not good."

*Sub-group A-3: Deaths due to Operation Directly.* In this group, the complications leading to death were those which occur after any of the supplementary procedures which were performed or after similar operations of comparable magnitude, and were not directly associated with either the ulcer or the vagotomy. Peritonitis was the cause of death in 7 patients, and subdiaphragmatic abscess in the eighth. In Case 15, after vagotomy and gastroenterostomy,



alterations in motility necessitated jejunostomy so that the vagotomy played a part in the final outcome. In Case 22 the patient died in shock two days after vagotomy and gastroenterostomy. The information obtained was extremely meager so that the cause of the shock could not be determined. Three deaths were due to cerebral vascular accident and one due to coronary occlusion; only the last was proved by autopsy. These were classified as due to operation directly as the onset occurred during the operative procedure.

*Sub-group A-4: Deaths due to Operation Indirectly.* This group of deaths were those which might follow any operative procedure of a major nature and which were not directly related to the vagotomy, the ulcer or the specific operation. Five deaths due to lower nephron nephrosis occurred, all of which were relatively clearcut. One death was due to renal insufficiency and the information obtained was insufficient to determine accurately the exact nature of this lesion. Cerebral vascular accident, cardiac failure and coronary occlusion were responsible for eight deaths. Eight deaths were due to pulmonary embolus; these represented 10.4 per cent of the total deaths.

*Sub-group B-1: Deaths due to Vagotomy.* One patient was classified in this group. After vagotomy, an esophageal fistula and empyema developed. With treatment of the empyema he improved sufficiently to be discharged from the hospital for a period of two weeks, although drainage persisted from the esophageal fistula. He returned to the hospital for treatment of the empyema and was progressing satisfactorily after rib resection and open drainage when he died from massive hemorrhage. At autopsy, there was found erosion of the aorta due to the esophageal fistula, and from this the fatal hemorrhage had occurred.

*Sub-group B-2: Deaths due to Ulcer.* Five patients were classified as late deaths due to peptic ulcer. In three of these perforation of the ulcer occurred with resulting peritonitis and death. A bleeding marginal ulcer led to the fourth patient's demise. In the fifth patient, very little response followed transthoracic vagotomy, with persistence of both symptoms and x-ray evidence of active duodenal ulceration. Nine months after the vagotomy a posterior gastroenterostomy was performed, followed by obstruction. Ileostomy and gastrostomy were then carried out but despite this the patient expired seven days later. The cause of death appeared to be intestinal obstruction and the chemical imbalance consequent to it.

*Sub-group B-3: Deaths due to Error in Diagnosis.* Two deaths were so classified and in both instances the choice of vagotomy as

TABLE IV  
GROUP A-4. DEATH DUE TO OPERATION INDIRECTLY

No.	Age	Obs.	Hem.	Route	Vagotomy Plus Following	P.O.		Cause of Death
						Day	Autopsy	
28	?	0	0	A	Gastroenterostomy. Closure Disruption	?	Yes	Lower Nephron Nephrosis
29	54	0	0	A	Wedge Resection Gastroenterostomy.	37	Yes	Lower Nephron Nephrosis
30	?	0	0	A	Closure Disruption	?	No	Lower Nephron Nephrosis
31	51	0	++	A	Excision of Ulcer and Pyloroplasty	14	?	Lower Nephron Nephrosis
32	49	++	0	A	Gastroenterostomy	8	Yes	Lower Nephron Nephrosis
33	?	?	?	A	Cholecystectomy	15	?	Renal Insufficiency
34	46	0	0	T	None	2	No	Cerebral Vascular Accident
35	?	0	0	T	None	4	No	Cerebral Vascular Accident
36	?	0	0	A	Gastroenterostomy, Appendectomy; Closure Disruption	6	Yes	Cardiac Failure
37	65	0	0	A	Gastric Resection and Cholecystectomy	14	Yes	Cardiac Failure
38	53	0	+	T	None	3	Yes	Cardiac Failure & Pneumonia
39	65	++++	0	A	Gastroenterostomy	6	Yes	Coronary Occlusion
40	47	0	0	A	None	2	No	Coronary Occlusion
41	?	++++	0	A	Gastroenterostomy and Splenectomy	12	Yes	Coronary Occlusion
42	54	+++	0	A	Gastroenterostomy. Closure Disruption	5	Yes	Pneumonia & Bronchiectasis
43	?	?	?	?	None	?	?	Pneumonia

TABLE IV (Continued)

No.	Age	Obs.	Hem.	Route	Vagotomy Plus Following	P.O.		Autopsy	Cause of Death
						Day	Day		
44	58	0	0	A	Gastroenterostomy	7	7	Yes	Atelectasis and Pneumonia
45	45	0	0	A	None	3	3	No	Atelectasis
46	65	0	0	A	Gastric Resection	9	9	No	Pulmonary Embolus
47	70	++	0	A	Gastroenterostomy	4	4	No	Pulmonary Embolus
48	57	?	?	A	Gastroenterostomy	24	24	No	Pulmonary Embolus
49	?	?	?	A	Cholecystectomy and Appendectomy	4	4	No	Pulmonary Embolus
50	42	0	+	T	None	9	9	Yes	Pulmonary Embolus
51	57	0	+++	A	None	9	9	No	Pulmonary Embolus
52	56	0	0	T	None: Drainage Empyema	30	30	No	Pulmonary Embolus
53	53	0	++	T	None	10	10	Yes	Pulmonary Embolus
54	66	+	0	A	Gastroenterostomy. Secondary Gastroenterostomy	15	15	Yes	Reaction to Plasma
55	?	?	?	T	None	14	14	Yes	Hemorrhage into Adrenal
56	66	+	0	A	Gastroenterostomy	11	11	No	Mesenteric Thrombosis
57	54	0	+++	T	None	6	6	Yes	Strangulated Hernia and Peritonitis

TABLE V  
GROUP B-1. DEATH DUE TO VAGOTOMY

No.	Age	Obs.	Hem.	Route	Vagotomy Plus Following	P.O.		Autopsy	Cause of Death
						Day	Day		
58	62	++	0	A	Gastroenterostomy	50	50	Yes	Esophageal Fistula with Hemorrhage from Erosion of Aorta

TABLE VI  
GROUP B-2. DEATH DUE TO ULCER

No.	Age	Obs.	Hem.	Route	Vagotomy Plus Following	P.O. Day	Autopsy	Cause of Death
59	43	+	0	T	Secondary Resection, Vagotomy, Closure Perforated Ulcer	142	Yes	Perforated Ulcer and Peritonitis
60	?	0	0	A	Gastric Resection	42	Yes	Perforated Ulcer and Peritonitis
61	?	?	?	A	Secondary Vagotomy	Over 180	Yes	Perforated Ulcer and Peritonitis
62	46	++	+	T	None, Closure Jejunocolic Fistula	74	Yes	Bleeding Marginal Ulcer
63	?	?	?	T	None, Gastroenteros- tomy, Ileostomy, Gas- trostomy	292	No	Intestinal Obstruction and Chemical Imbalance

TABLE VII

GROUP B-3. DEATH DUE TO ERROR IN DIAGNOSIS

No.	Age	Obs.	Hem.	Route	Vagotomy Plus Following	P.O. Day	Autopsy	Cause of Death
64	43	++	0	T	None	240	Yes	Carcinoma of Stomach
65	44	0	0	A	Gastroenterostomy	390	Yes	Carcinoma of Stomach

the method of treatment was logical even on reconsideration. In the first instance, the patient had had symptoms of ulcer for three and one-half years. Three months prior to operation a duodenal ulcer had been demonstrated by x-ray. However, just before operation, the radiologist reported normal stomach and duodenum. Because of persistent symptoms a transthoracic vagotomy was carried out. No opportunity for abdominal exploration was afforded. Complete relief of symptoms followed and the patient expired in another hospital eight months later. The autopsy showed a carcinoma of the stomach. Obviously had subdiaphragmatic vagotomy been carried out, the carcinoma of the stomach might have been found and recognized. At that time, however, the transthoracic route was being employed. Vagotomy appeared to be the procedure of choice with the symptoms and the radiologic findings reported.

The second patient had had ulcer symptoms for 15 years which became refractive to medical therapy a few months prior to the operation. A subdiaphragmatic vagotomy and gastroenterostomy were carried out. There was "duodenal scarring with extension of scar induration into the gastrohepatic ligament." The patient did very well until 13 months later, when he had a sudden severe gastric hemorrhage followed by death. At autopsy, a carcinoma of the pyloric end of the stomach with extensive metastasis was found. The inability to differentiate clinically or roentgenographically benign ulceration from carcinoma is well known. Even by palpation at the operating table differentiation cannot be made at times. It is reasonable to accept the diagnosis of benign ulcer with the lesion as described and to assume that only by excision of tissue for biopsy could the diagnosis have been made at the time of operation.

*Sub-group B-4: Deaths due to Unrelated Causes.* Twelve deaths occurred at various intervals after vagotomy and discharge from the hospital. In only three could there be any question as to the exact cause of death and of any relationship to the previous operation. The first of these, Case 74, was a 31 year old man who had a transthoracic vagotomy. Prior to operation, in addition to his ulcer symptoms, he had repeated episodes of severe diarrhea for which no cause could be found. After vagotomy, his ulcer symptoms were greatly improved but the diarrhea and occasional vomiting continued. In spite of repeated hospitalization, his course was progressively downhill and he died of malnutrition and inanition due primarily to the diarrhea. Case 76, a 55 year old man, had a transthoracic vagotomy for ulcer with uneventful recovery. A month after discharge he was admitted with signs of mechanical small bowel obstruction and at exploration a segment of paralytic ileus

in the upper ileum was found. With symptomatic treatment, he responded satisfactorily. The obstruction recurred ten months later. All x-ray studies and other laboratory findings were negative with the exception of a blood calcium of 8.5 mg. per hundred cubic centimeters. He again made a satisfactory recovery and was discharged on calcium therapy. A month later he was admitted in circulatory collapse and died shortly thereafter. Autopsy showed dilated right heart, paralytic ileus in upper ileum and healing duodenal ulcer. It was the surgeon's opinion that "disturbed calcium metabolism may have been a contributing factor in this unusual chain of events." Case 77 had transthoracic vagotomy for jejunal ulcer which had followed earlier gastroenterostomy. Very few details were given in the case report but death occurred ten months later. Autopsy showed no active peptic ulcer; there was severe, acute, diffuse, ulcerative esophagitis and colitis, pituitary tumor and adrenal cortical adenoma. The exact cause of death was not determined, but it seemed probable that the esophagitis and colitis were the proximate causes.

*Disturbances in Pain Transmission.* Six cases were found in whom some type of intra-abdominal catastrophe occurred after operation which was not manifested by the usual symptoms and signs. Since the original intent of this study was to consider this occurrence, these cases will be abstracted in more detail.

CASE 9. A 47 year old man had had ulcer symptoms of 15 years' duration with three episodes of massive hematemesis. The patient was a chronic alcoholic. He had had headaches and nocturia for two years. The blood pressure was 210/140 and the heart was moderately enlarged. Moderate epigastric tenderness was present. Hyperacidity was found and a duodenal ulcer was demonstrated by x-ray. Transthoracic vagotomy and left thoracolumbar sympathectomy were carried out. Thirteen days later a right thoracolumbar sympathectomy was performed. From the third to the sixth day marked gastric dilatation was present and at this time deterioration began. The patient was restless and very irritable. Twenty-eight days after vagotomy he complained of slight lower abdominal pain and slight diffuse tenderness was found. Two hours later, shock developed and he expired 12 hours after that. At autopsy, a perforated ulcer with generalized peritonitis was found. The surgeon emphasized that the patient did not have the acute pain associated with a perforated ulcer.

CASE 16. A 55 year old man had had ulcer symptoms for 30 years, becoming more severe and not responding to medical therapy over a period of six months. Examination showed moderate epigastric tenderness and hyperacidity was found. X-ray showed a duodenal ulcer. A transthoracic vagotomy was carried out and at the same time a transabdominal pyloroplasty. Two duodenal ulcers were found. The patient developed atelectasis on the fourth day which improved with the usual treatment. He had rather persistent abdominal distention which caused the usual pain. On the eleventh day duodenal drainage from the upper part of the abdominal wound began and continued until the



TABLE VIII  
GROUP B-4. DEATH DUE TO UNRELATED CAUSES

No.	Age	Obs.	Hem.	Route	Vagotomy Plus Following	P.O. Day	Autopsy	Cause of Death
66	64	++	+	A	Gastroenterostomy	60	?	Bronchogenic Carcinoma
67	?	++	0	A	Gastroenterostomy	270	Yes	Periarteritis Nodosa
68	?	?	?	T	None	270	Yes	Cerebral Vascular Accident
69	56	0	+	T	None	Over 360	No	Cerebral Vascular Accident
70	56	0	0	T	None	420	No	Coronary Occlusion
71	57	?	?	A	Gastroenterostomy	420	Yes	Coronary Occlusion
72	46	0	0	A	Gastroenterostomy	540	Yes	Coronary Occlusion
73	?	?	?	A	Closure Gastro- Jejunocolic Fistula	120	No	Coronary Occlusion
74	31	+	0	T	None	660	No	Malnutrition
75	41	0	++	A	Gastroenterostomy	90	Yes	Lobar Pneumonia
76	55	0	0	T	None	360	Yes	Circulatory Collapse— Cause?
77	?	?	?	T	None	300	Yes	Ulcerative Colitis and Esophagitis

time of his death. For alimentation, a jejunostomy was performed on the eighteenth day. On the following day there was a sudden massive hemorrhage through the duodenal fistula followed by death. At autopsy, leakage at the pyloroplasty suture line, generalized peritonitis, subdiaphragmatic and pelvic abscesses, ulceration proximal to the pyloroplasty, pulmonary edema and atelectasis were found. The bleeding point could not be demonstrated. This patient had abdominal pain associated with his distention and when this could be relieved by gastric suction, the pain improved. However, he did not have either the pain or the tenderness which one would generally expect to find in the presence of peritonitis or the localized pain to indicate the subdiaphragmatic and pelvic abscess formation.

CASE 17. A man of unstated age had had ulcer pain over a period of three months accompanied by vomiting and on one occasion hematemesis. He had had similar symptoms four years earlier which responded promptly to medical therapy. No tenderness was present on abdominal examination and the x-ray showed a chronic duodenal ulcer with early obstruction. Subdiaphragmatic vagotomy and pyloroduodenoplasty were carried out. There were marked adhesions about the duodenum with multiple ulcers and narrowing. On the third day he developed pneumonia in the left lower lobe, and on the fourth day became febrile, appeared toxic and was irrational at times. Ileus was also noted. Icterus developed on the sixth day but gradually decreased. He lost ground steadily and expired on the eighth postoperative day. Autopsy showed acute, purulent, generalized peritonitis secondary to necrosis of the suture line with perforation and leakage of a posterior duodenal ulcer. It could not be determined whether perforation or the leak at the suture line occurred first. Comment of the operating surgeon was, "The most remarkable thing was the absence of pain and tenderness in the abdomen throughout the early postoperative course, probably due to absence of acid in the gastric secretion. On the last two days he did have some pelvic tenderness which was never very marked."

CASE 18. The sex, age, symptoms and preoperative findings were not stated. Subdiaphragmatic vagotomy and gastroenterostomy were carried out. The postoperative course was characterized by gastric retention and hypoproteinemia, the latter responding but slightly to treatment. The patient died on the fourteenth postoperative day. Autopsy showed a subdiaphragmatic abscess. No other information was given in the summary. Comment of the surgeon, however, was "the abscess was unsuspected and there was no pain to speak of."

CASE 56. A 66 year old man had an ulcer history over a period of 20 years. Perforation had occurred 15 years earlier and gastroenterostomy had been performed 10 years earlier. Three months prior to admission the pain had recurred and was more severe at night. X-ray showed a marginal ulcer with stenosis at the anastomosis. Subdiaphragmatic vagotomy and anterior gastrojejunostomy were performed. The patient did quite well until the seventh day when vomiting began. Vomiting persisted and became slightly bloody on the eleventh day, when he expired. No autopsy was performed and death was thought to be due to mesenteric thrombosis. Comment of the surgeon was, "This case may be of interest because of his lack of pain except for the incision."

CASE 57. A 54 year old man had had ulcer symptoms for 30 years. Gastroenterostomy had been performed 17 years earlier. Three episodes of hemorrhage had occurred, the last six days prior to admission. No tenderness was

found on abdominal examination. There was a small left inguinal hernia. The hemoglobin was 7.6 grams and the red blood cell count was 2,350,000. X-ray showed spasm suggesting a jejunal ulcer two inches distal to the anastomosis. Transthoracic vagotomy was carried out. The patient did very well until 72 hours after operation when moderate abdominal distention and marked dyspnea occurred. On the fifth day, shock with cyanosis and abdominal distention developed. He improved with gastric suction and other supportive measures but then gradually failed and expired the sixth day after operation. At autopsy a Richter's hernia was found. The wall of the ileum had incarcerated in the left internal inguinal ring with consequent angulation of the ileum causing obstruction and strangulation. Perforation and generalized peritonitis had followed. The patient had practically no abdominal pain and no tenderness. A strangulated hernia had been considered but as no mass could be felt and no local tenderness elicited, operation was not performed.

The inconsistencies and contradictions of the clinical aspect of visceral pain are well known. Why some of the patients should have little or no pain and essentially no signs of peritonitis while others have the typical symptoms and signs cannot be explained. It is difficult to understand why simply sectioning of the vagus pathway at the level of the diaphragm should result in such extensive alteration in the transmission of pain impulses. The extensive sympathetic innervation of the abdominal viscera remains intact and the sacral parasympathetics are undisturbed.

Clinically this discrepancy may be further illustrated by the following. In a posterior penetrating ulcer, the intractable pain is apparently due principally to inflammatory reaction in the pancreas, and this pain can be relieved immediately by vagotomy. In contrast to this, the patient who has acute pancreatitis with extremely severe pain will obtain relief by splanchnic block. Admittedly, the etiology and the extent of the inflammatory reaction in the pancreas differ but such relief of pain by opposing methods is confusing. Apparently, there must be pain fibers in both the sympathetic and parasympathetic outflow from this area, but the exact reason why one or the other may predominate is not clear. For the present, it can only be said that exact knowledge of many aspects of visceral pain is lacking and that after vagotomy an intra-abdominal catastrophe may occur without the usual symptoms and signs.

#### SUMMARY

Upon considering the entire group of deaths which have occurred following vagotomy, no reasons for or against the procedure were definitely enumerated. Only a very few of the deaths were attributed directly to the vagotomy, whereas the majority of the deaths were those which might have followed any major operative procedure. Further, a considerable number of the deaths would prob-

ably have occurred within a few months had the patient had no surgical intervention.

Certain measures should be undertaken to avoid those accidents placed in the vague category of vagal reflex death. Ethylene or ether anesthesia might be preferable to cyclopropane because the latter will cause alteration in cardiac conduction. Preliminary novocaine injection and gentleness in manipulating the vagus nerves also appears indicated. Electrodes should be available to assist in converting ventricular fibrillation.

In some patients, the vagus nerves may be fairly deeply imbedded in the esophageal musculature, a situation requiring careful dissection under direct vision to avoid perforation or laceration of the esophagus. If the stomach cannot be adequately decompressed by a transnasal intragastric tube or the patient will not tolerate such a tube, then gastrostomy or gastroenterostomy may be required to avoid such complications as aspiration pneumonia.

The frequency of pulmonary embolus in this series of deaths again suggests the necessity for frequent examination of the extremities and active therapy should phlebothrombosis develop. In the case of gastric ulcer, resection is probably preferable to vagotomy with a drainage procedure, in order that no carcinoma be overlooked.

#### CONCLUSIONS

1. In an occasional patient such alterations occur in the transmission of visceral pain impulses that an acute surgical condition may develop intra-abdominally without the usual signs and symptoms.
2. Great care and gentleness should be exercised in any manipulations of the vagus nerves and the esophagus in order to avoid (a) reflex cardiac arrest (b) laceration of the esophagus.
3. The probability of gastric retention should be recognized and measures carried out to prevent its occurrence.
4. The abdominal approach is preferable in order that the ulcer may be examined. For gastric ulcer, resection is probably best in order that a carcinoma may not be missed. Even with the subdiaphragmatic approach, pulmonary complications may arise and esophageal damage may be overlooked.

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## TOTAL VERSUS SUBTOTAL HYSTERECTOMY

E. L. HENDERSON, M.D.

J. LUTHER FULLER, M.D.

Louisville

**T**OTAL hysterectomy or panhysterectomy means complete removal of the uterus including the cervix. In subtotal hysterectomy the cervix is not removed.

Voluminous literature has accumulated on the subject of total or subtotal hysterectomy in the past few years, and on the route by which it should be done, abdominal or vaginal.

As a basis for discussion of this paper indications for hysterectomy, the choice of technical procedure, and technic will be discussed; 550 personal cases which we have done in the past three and one-half years will be analyzed. Statistics from individual surgeons, clinics and hospitals will be presented.

In our 550 cases, 87 per cent were total abdominal hysterectomies, 9 per cent were total vaginal hysterectomies, and 4 per cent were subtotal hysterectomies, an average of 96 per cent total and 4 per cent subtotal. Our mortality for the series was .91 per cent.

The general trend is toward total hysterectomy. Mergert and Stoltz<sup>1</sup> in observations based on 1,925 hysterectomies showed that prior to 1932, 100 per cent were subtotal, since 1940 95 per cent have been total hysterectomies. Jones and Doyle quoted a series of 2,773 hysterectomies in which 95 per cent were total. Danfourth<sup>2</sup> in a series of 1,510 cases reported 32 per cent were total vaginal hysterectomies. Counsellor<sup>3</sup> states that at the Mayo Clinic total abdominal hysterectomies is done in 85 per cent and subtotal in 15 per cent of abdominal hysterectomies.

Jones and Doyle, in a survey of the literature, reported in 16,851 cases the mortality of total hysterectomy was 4.1 per cent and for subtotal 2.4 per cent. Foss,<sup>4</sup> in presenting a paper on total hysterectomy, showed the average mortality of 3.87 per cent in total hysterectomy and 2.35 per cent for subtotal in a large series of cases done by 22 eminent surgeons. Suffice it to say that the overall mortality of total hysterectomy is about 4 per cent and for subtotal about 2 per cent.

The most common conditions which necessitate total hysterectomy are uterine fibroids associated with disease of the cervix, car-

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Read before the seventeenth annual Postgraduate Surgical Assembly of The Southeastern Surgical Congress, Biloxi, Miss., May 23-26, 1949.



cinoma of the fundus, chronic pelvic inflammatory disease, ovarian malignant lesions, endometriosis, and prolapse.

The most frequent pathologic condition requiring removal of the uterus is fibroids. Small ones which do not cause symptoms do not require treatment, but when hemorrhage, which is usually manifested as menorrhagia or pressure symptoms, appears treatment is indicated. There are three accepted treatments for fibroids: (1) excision of the tumor alone or myomectomy which may be performed either vaginally or abdominally, (2) hysterectomy, and (3) radiation. It is only when preservation of the child-bearing function is a factor that the operation of abdominal myomectomy is applicable. The large majority of patients with large or multiple fibroids are best treated with hysterectomy. Frequently the extraordinary attempts to preserve the uterus necessitate further surgery. The uterus which contains large symptom-producing myomas is not likely to carry a pregnancy to term. Ovarian function which is desirable in young women is destroyed by radiation therapy. In patients where operation is contraindicated or at an age where the preservation of ovarian function is not essential, radiation of small myomas causing hemorrhage is an alternative method of treatment.

The logical argument for total or subtotal hysterectomy is the pathologic condition of the cervix and its potential future. The cervix alone has no specific function. In cases in which hysterectomy is contemplated the cervix should be inspected and palpated carefully. Cervical erosions, lacerations, endocervicitis, cystic cervicitis and polyps all indicate that the cervix is unhealthy. The external os may be firm and smooth and active endocervicitis may be overlooked. Cervices which contain polyps are much more prone to develop carcinomatous changes later. Considerable research has demonstrated that the cervix is a frequent source of infection and this has a definite relation to other infectious processes within the body such as infections of the small joints, retinitis, and choroiditis. Infections of the cervix are related to infections of the urinary tract. A cervix which appears to be normal may become infected after subtotal hysterectomy as a result of interference with its normal blood supply and also because of a possible cessation of its normal physiologic action. It is not uncommon to have to remove a retained cervical stump because of its residual inflammatory character. For these reasons it has become increasingly difficult to determine which patients should be treated by subtotal hysterectomy as it is impossible to determine if a cervix will continue to be healthy.

When the individual is in the mid-portion of life, near or after menopause, has borne children, has an infected cervix, enlarged or eroded or scarred by lacerations, with or without appreciable leu-

corrhea, we believe the cervix should always be removed along with the fundus. It does not seem desirable to remove the uterine disorder and retain the most vulnerable portion from the standpoint of cancer or distressing sequelae.

The mobility of the cervix is a very important consideration in abdominal hysterectomy. In the nulliparous patient, in a young, single individual, if the cervix appears normal, subtotal hysterectomy is to be considered. If it is done, conization or cauterization with the actual cautery should be done preceding the hysterectomy.

If the patient is fat, the pelvis deep and inaccessible, or the lower uterine segment fixed by fibrosis or endometriosis with a firmly adherent rectum and rectosigmoid, total hysterectomy is contraindicated. One should not forget that removal of a cervix, which may lie deep in the pelvis and be firmly fixed, carries the surgeon in a definitely dangerous zone as far as the ureter and bladder are concerned. Marked obesity, the unusually narrow, deep pelvis, extensive adhesions which fix the uterus and cervix almost solidly to the rectum, are conditions which should influence us in a certain number of cases to choose between the total and subtotal method. In one of our cases with marked obesity, a narrow, deep pelvis, and an immobile cervix, we did a subtotal hysterectomy for what we thought was a benign myoma. Imagine our surprise when the pathologic report returned, leiomyosarcoma, a condition which occurs about once in 500 cases.

The problem of carcinoma in the cervical stump is a real one and there is no excuse for not removing the cervix except in a bad risk patient where anatomic difficulties exist. A very important reason for complete removal of the cervix is the occurrence of malignancy in the retained cervical stump. About 80 per cent of all uterine carcinomas occur in the cervix. The incidence of cervical stump carcinoma is between 2 and 5 per cent. More than 2 per cent of all deaths in women are due to uterine carcinoma according to local health department and life insurance company statistics. Conization and cauterization have certainly destroyed or prevented some carcinomas but the 2 to 5 per cent of the patients who develop carcinoma in the cervical stump which has been left is hard to justify unless there was some specific contraindication to total hysterectomy. It must be remembered that conization and cauterization protect only against adenocarcinoma of the cervix, not against squamous cell carcinoma which is by far the most common.

Cosbie,<sup>5</sup> of Toronto, showed, in a 16 year summary of 890 patients from 1929 to 1944, carcinoma of the remaining cervix developed in 62 patients. Scheffey<sup>6</sup> of Jefferson Hospital observed

21 cervical stump carcinomas in 541 patients. Foss<sup>4</sup> showed the average incidence of cervical stump cases collected from statistics of 16 eminent surgeons and clinics to be 2.69 per cent. The Mayo Clinic reported 4.4 per cent cervical stump malignancies found.

While total hysterectomy is the specific treatment for carcinoma of the fundus and adnexa it is not the accepted treatment for carcinoma of the cervix. Total abdominal hysterectomy is done for grade I carcinoma of the cervix and followed by radiation therapy. Carcinoma of the fundus often originates on the lateral walls of the uterus and extends into the cervical canal. It is impossible to manipulate the uterus during hysterectomy and not extrude some of the malignant cells into the cervical canal. If curettement was done prior to hysterectomy to prove the presence of fundal carcinoma malignant cells are most certainly present in the cervical canal. Fundal lesions in a certain percentage always extend into the tubes and ovaries and, regardless of the patient's age, bilateral salpingo-oophorectomy and total hysterectomy should be done with all cases.

Carcinoma of the ovaries is best treated by means of total abdominal hysterectomy together with bilateral salpingo-oophorectomy if the condition is operable. If operable, even with omental or peritoneal implants, total hysterectomy should be done, and followed with x-ray and radiation therapy, as about 25 per cent of these patients will survive 5 years or more.

Endometriosis and adenomyosis cases are the ones in which decision between total and subtotal hysterectomy is most difficult. The disease is encountered in much younger women than carcinoma and many of them are nonparous though some will have had children. The sterility rate in these cases is high, about 35 to 45 per cent. When the patient is a young, nonparous woman, subtotal hysterectomy is indicated more frequently, especially if there are implants and fixation in the rectovaginal septum and rectal wall. This decision should be made on the condition and mobility of the cervix in each case.

If one ovary is free of endometrial implants preservation of the ovarian tissue is desirable, but unfortunately most cases are bilaterally involved, and both ovaries must be sacrificed. When patients who have one or more children become sufficiently involved to necessitate hysterectomy, total hysterectomy is indicated if technically possible, and both ovaries should be removed.

Pelvic inflammatory disease often necessitates hysterectomy. We believe that when the uterus is left behind following operations for residues of pelvic infection, pelvic pain, dyspareunia, abnormal bleeding, and leucorrhea have frequently persisted and occasionally

necessitated another operation for removal of the uterus. We feel that, unless the cervix is dangerously fixed by fibrous tissue, it should be removed when possible.

Occasionally hysterectomy has to be done to control hemorrhage of endocrine origin. Hysterectomy, though radical, not only controls bleeding but permits establishment of an accurate diagnosis. This has been done after multiple curettements and endocrine therapy have failed.

Some of the advantages of subtotal hysterectomy are the simplicity of technic, the slight blood loss, absence of postoperative morbidity, very low mortality, diminished surgical time required for performance, and the large unsterile field of the vagina is not invaded. The subtotal hysterectomy holds a definite and respected position in surgery and should be used when the opportunity has not been availed to standardize a technic for total hysterectomy.

Abdominal hysterectomy has become so safe a procedure in recent years that many have forgotten that the vaginal route is even safer with a lower mortality and fewer complications. Some cases are advantageously operated on by one method, some by another. For this reason we feel that everyone doing gynecologic surgery should be well versed on both abdominal and vaginal technical procedure.

Vaginal hysterectomy is decidedly the most adaptable operation for prolapse. In general, it can be stated that all uteri are best removed vaginally if the organ can be delivered without morcellation and if there is no evidence of a malignant lesion or adnexal disease of a considerable degree.

Vaginal hysterectomy can be done with less shock. It is practically an extraperitoneal operation. The incidence of shock is less because there is minimal trauma and loss of blood. Ileus and gas pains are observed less frequently. The entire uterus is removed, including the cervix, thus preventing future cervical pathology developing. The incidence of postoperative hernia, wound infection, or painful abdomen are minimal since there is no abdominal incision. Pulmonary complications are less frequent because without the abdominal incision there is less splinting of the diaphragm. The incidence of thrombophlebitis and pulmonary emboli is less. No abdominal operation can cure a cystocele or enterocele which so commonly accompanies uterine prolapse.

If cystocele, rectocele, prolapse, and urinary incontinence are present, certainly the vaginal approach is most logical. There is less surgical risk by vaginal hysterectomy and repair, than by abdominal approach and then vaginal plastic work being done. It is

frequently observed, if abdominal work is done and not completed with the vaginal work at the same time, the patient puts off the second operation or vaginal plastic until the condition reaches a distressing degree of severity. Poor risk patients who do not tolerate abdominal procedures can be safely operated on by the vaginal route. Obesity, age, and cardiovascular disease rarely contraindicate vaginal hysterectomy.

The contraindications to vaginal hysterectomy are (1) pelvic inflammatory disease with adhesions, (2) very large tumors, (3) previous pelvic surgery, (4) malignant disease of the uterus. If, on examination with the patient under anesthesia, the organs are not mobile and seem fixed or of a size not compatible with the outlet, the wise and conservative plan is to utilize the abdominal approach.

Vaginal shortening has been mentioned as a contraindication to total abdominal hysterectomy. The vagina presents considerable individual variations in length. Since it is united with the uterus at an acute angle, its anterior wall measures 6 to 8 centimeters and is always shorter than its posterior wall which measures 7 to 10 centimeters. It is difficult to understand how total hysterectomy can influence greatly the length of a structure which has individual variations. The cervix is removed at its junction with the vaginal vault. A few millimeters may be lost where the sutures are taken across the vaginal vault, and the anterior-posterior dimensions may be diminished but not the depth appreciably. We will agree that some very short vaginas exist, but many of these are congenitally short and existed preoperatively. We do not consider vaginal shortening a logical argument against total abdominal hysterectomy.

Dryness of the vagina has been mentioned as an undesirable condition associated with total hysterectomy. It is true the vagina has no glands. The cervix is only a part of the lubricating system. The Bartholin gland and Skene glands provide adequate lubrication for physiologic procedures associated with coitus. After interrogating many patients we have never had any complaint of a "dry vagina," but troublesome leucorrhea has certainly been a frequent complaint and distressing symptom in many a patient in whom the cervix was not removed.

The technic of subtotal abdominal hysterectomy varies little. This is not true of total abdominal hysterectomy. There are certain points we feel it desirable to mention. After catheterization of the bladder, the vagina is prepared. Infection from the vagina after adequate preparation is almost negligible. Adequate exposure facilitates surgery. We feel it is important to carry the inferior end of the abdominal incision to the symphysis pubis. Exploration of



the abdomen is the first step. Appendectomy is done routinely if the appendix was not removed at previous surgery. The stump is treated with the phenol-alcohol purse string inversion technic. With the patient in the Trendelenberg position, the uterus and adnexa fixed, the intestines packed off, a tenaculum forcep is placed on the fundus to facilitate manipulation except where pyometra or carcinoma of the fundus is suspected. Clamps are placed on the broad and round ligaments and these are severed from the uterus. The peritoneum and bladder are removed from the anterior inferior surface of the uterus early. The uterine vessels are exposed by careful dissection and particular attention paid to the ligation. The fascia which lies over the cervix is separated from the cervix by dissection and the fascia and bladder are then pushed away from the cervix and upper vagina as far as is necessary. With this procedure the ureters drop well away and there is no need to fear injury to them. The uterosacral ligaments are removed from the posterior surface of the cervix. The method of opening the vagina posteriorly between the uterosacral ligaments is safer than to open it anteriorly. The vagina is then separated from the cervix all the way around, leaving none of it attached to the cervix even where lacerations are present. Two long straight Ochsner clamps are placed in the lateral fornix of the vagina for traction. With the bladder rolled forward a figure-of-eight chromic catgut suture is placed in the mid-portion of the vaginal vault. The first suture is left long and used for traction. Interrupted figure-of-eight sutures are then placed to the right and left of the first suture, each interlocking the preceding figure-of-eight suture for hemostasis. A curved noncutting needle is used to prevent cutting out and sutures. After the vaginal vault is closed, the uterosacral ligaments, broad and round ligaments are sutured to the stump of the vaginal vault for support. This area is then peritonealized with the bladder peritoneum, which was previously reflected from the anterior surface of the uterus, and all raw areas are peritonealized. Adequate hemostasis and elimination of "puddling" in the pelvis seem to be most important to insure a smooth postoperative course.

We do not advocate general adoption of total hysterectomy. Individualism is as wise here as in every other surgical procedure. The decision should be made upon a consideration of the pathology involved, the condition of the cervix, the technical problems presented by the individual case and a conscientious self-appraisal by the surgeon of his own capabilities.

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## VESICAL DYSFUNCTION FOLLOWING ABDOMINO-PERINEAL RECTOSIGMOIDECTOMY

GEORGE H. EWELL, M.D.

Madison, Wisc.

I SHALL begin this paper by reading the summary and conclusions, after which I shall present information obtained from the literature and from our own personal clinical experience in an attempt to outline briefly the present day concept of urologists concerning the causes of, and the management of, vesical dysfunction following abdominoperineal rectosigmoidectomy.

Infection of the urinary tract and retention of urine are the most consistent and most troublesome complications of abdominoperineal rectosigmoidectomy.

In approximately 15 per cent of the cases, the majority of which occur in males, urologic investigation is required. Infection, overdistention of the bladder, trauma to the pelvic autonomic nerve plexuses supplying the bladder, paravesical and vesical wall edema incident to the operative trauma, and vesical neck obstruction are the most important factors contributing to the development of urinary retention and vesical dysfunction.

The morbidity of urinary infection in these cases certainly has been reduced as a result of the sulfonamide drugs and antibiotics. The use of the sulfonamides for the preparation of the bowel prior to operation and postoperatively probably has been a factor in the decrease of the morbidity.

The management of these patients should begin prior to the operation. While the patient may be concerned chiefly with his bowel difficulty, the physician should consult with the patient to determine any symptoms which may be referable to the urinary tract. This is especially important in cases of obstruction or impending obstruction where, due to the severity of the intestinal symptoms, an already overdistended bladder may be overlooked.

In some instances cystoscopy may be necessary. In a few instances where the history suggests and urologic examination demonstrates a vesical neck obstruction, relief of the obstruction by transurethral resection or prostatectomy should precede the abdominoperineal resection.

We advise the use of a small self-retaining catheter (16 Foley) which should be inserted prior to the operation; as frequently, due to unavoidable delay, prolongation of the operation, the use of fluids intravenously, and because of sedation and analgesics the patient's

inability to recognize the sensations of a full bladder postoperatively, overdistention of the bladder may occur.

If overdistention occurs in the presence of a minor degree of vesical neck obstruction, for which the bladder was previously compensated, a breakdown of compensation occurs, and for treatment may require prolonged drainage or removal of the obstruction.

The duration of the period of catheter drainage is important. Five to ten days is the average period. Continuous drainage with a closed system we have found most satisfactory. If, following the removal of the catheter, difficulty develops or frequency with the passage of small amounts of urine, the patient should be catheterized for residual urine. If 100 c.c. or more of residual urine is found, the catheter should be reinserted for another period of time.

We advise that the patient be given several trials with the catheter and the use of one of the parasympathetic stimulant drugs, such as mecholyl bromide. During this time cystometric studies and cystoscopic examination should be done. If the cystometrogram shows a definite type of curve, due to nerve injury or vesical wall fixation, and cystoscopy reveals the absence of vesical neck obstruction of moment, catheter drainage should be continued. In some of these cases, catheter drainage may be required for many days. Resection of the entire circumference of the vesical neck in this type of case is necessary at times.

During recent years, many writers in discussing this subject have noted a variation in the statistical incidence of the frequency of complications in the urinary tract following abdominoperineal operation for carcinoma of the rectum. Some surgeons have noted that 100 per cent of their cases develop urinary tract complications, while others report a small incidence.

The fact remains that infection of the urinary tract and retention of urine are the most consistent and most troublesome complications which occur.

Infection is undoubtedly the most common type of urinary complication which occurs, and it is probably infection to which some surgeons refer when they state that 100 per cent of their patients develop urinary tract complications. The infection may manifest itself as a mild cystitis or a severe cystitis with retention and unilateral or bilateral pyelonephritis.

In elderly patients a severe pyelonephritis may be a serious complication. Strict attention to the details of preoperative and postoperative management will reduce the severity of the infection and minimize the symptoms, but not prevent its occurrence.

Approximately 10 to 15 per cent of all patients having an abdominoperineal operation will develop a serious urinary tract complication.

These complications may occur early or late, they may respond readily to treatment or may produce a prolonged disability, and major surgical procedures are required for their correction. Death may follow a transurethral resection of the vesical neck or prostate for the relief of urinary retention in a patient who has made an otherwise uneventful recovery from his abdominoperineal operation as in the following case:

F.W.H., a 78 year old man, came to the Clinic in April, 1945, because of recurrence of gastric symptoms and rectal bleeding. He had been treated in the Clinic during the years of 1941 and 1942 for a gastric ulcer. The last x-ray examination in 1942 had revealed a healed gastric ulcer.

X-ray examination at the time of his last admission disclosed a carcinoma in the area of the old gastric ulcer. Rectal examination disclosed a cauliflower type of mass on the posterior wall of the rectum just above the sphincter, biopsy specimens of which revealed an infiltrating papillary carcinoma.

The prostate was atrophic and fibrous. There were no urinary symptoms.

A subtotal gastrectomy and a gastrojejunostomy were done, following which recovery was uneventful. Approximately one month later a Lynch operation was done for the carcinoma of the rectum. Recovery was uneventful except for inability to void.

He was treated by intermittent catheterization and Foley catheter drainage. Approximately three weeks following the Lynch operation, cystoscopy revealed a prostatic bar with vesical neck contracture. The bar and the circumference of the vesical neck were resected. Following the removal of the Foley catheter he was unable to void at times or voided large quantities with sizeable quantities of residual urine.

At the time of his discharge from the hospital he was being catheterized twice daily. A few weeks following his discharge he developed chills and fever and the physical findings of an acute bilateral pyelonephritis. He was given sulfonamides and penicillin therapy. Death occurred from urosepsis.

Before proceeding to a discussion of the causes and treatment of vesical dysfunction, following abdominoperineal operations, it may be well to mention briefly those complications which occur as a result of surgical trauma to the urinary tract, such as ureteral and vesical injuries. Such cases usually present individual problems and must be dealt with accordingly.

The surgeon who does this type of large bowel surgery is to be congratulated on the low incidence of ureteral injuries.

The surgeon in most instances is careful to identify the left ureter, but he should always bear in mind that injury to the right ureter occurs in a fair number of cases. It should be incumbent on the surgeon to identify both ureters.

When ureteral injury is recognized at the time of operation, a repair of the hiatus should be made, or, if the ureter has been divided, reimplantation into the bladder or an end to end anastomosis with a splinting catheter should be done. The method described by Curtis is an excellent one.

It is imperative that urologic investigation be done to establish the site of injury to the urinary tract as soon as urinary leakage either from the abdominal or, as is usually the case, from the perineal wound occurs.

The early recognition of these injuries and adequate care may prevent the morbidity associated with progressive hydronephrosis and pyelonephritis, and obviate the need for nephrectomy.

Those complications which occur as a result of invasion of the bladder by the growth may also be responsible for problems in diagnosis and subsequently for postoperative vesical complications.

We observed a patient with these complications during the past two years.

D.B., a 63 year old man, came to the Clinic only because of frequency and terminal dysuria and hematuria of several months' duration. His past history disclosed several attacks of left lower abdominal pain, the first attack having occurred thirty years previously. The history of the attacks suggested intestinal origin, probably a diverticulitis. There was no history of passage of blood from the rectum.

A cystogram revealed an extensive filling defect. At cystoscopy an infiltrating neoplasm of the bladder wall was suspected. The pathologic examination of sections removed from several areas was reported as chronic inflammatory tissue.

Roentgenographic examination of the gastrointestinal tract revealed a carcinoma of the sigmoid, and at operation an abscess was found between the attachment of the bowel to the urinary bladder. A section removed from the bladder wall and from the peritoneal surface of the bowel revealed no evidence of neoplasm, and no neoplastic cells were found in some small mesenteric nodes. An anterior resection was performed.

For a time following the operation his vesical function was greatly improved. The frequency and terminal dysuria with hematuria then recurred. Cystoscopy revealed an extensive neoplasm which on section was of an intestinal type. Obviously neoplastic cells had invaded the bladder wall at the time of our original examination but were not detected in the sections which we removed.

This is the type of case which may be subjected to ureteral transplantation and cystectomy done with the removal of the lower bowel segment.

Those cases which develop urinary retention following an abdominoperineal rectosigmoidectomy are to be accorded the greatest consideration in this discussion. The cause or causes of urinary

retention following abdominoperineal resection are not clearly understood.

There are certain etiologic factors that must be kept in mind. Vesical neck obstruction, minor in nature, may be exacerbated after the operation or urethral obstruction due to urethral strictures, and as Ewert suggested, the resistance offered by the urethra itself may cause retention in the presence of detrusor muscle dysfunction.

Urinary retention in the absence of demonstrable obstruction or minimal obstruction has not been adequately explained.

The physiology of the normal act of micturition is an interesting study and will be discussed only briefly in this paper. The normal filling and adequate emptying of the bladder depends chiefly upon the proper function of the detrusor muscle and the associated relaxation of the autonomic internal and the voluntary external sphincter.

For this normal process an adequate nerve supply, a tonic and freely movable bladder wall, with adequate support and the absence of abnormal obstruction at the vesical neck, is necessary.

McCrea has been one of the chief proponents of the neurogenic theory of vesical dysfunction. As a result of trauma to or removal of the inferior, hypogastric, or pelvic nerve plexuses, an atonic

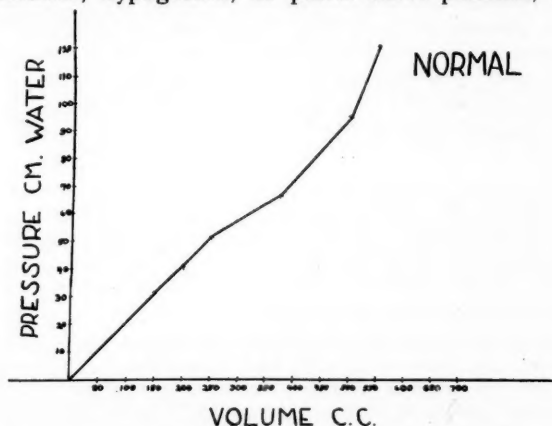


Fig. 1. A composite of a group of normal adult cystometrograms.

bladder then develops. The cystometrogram in such cases shows a flattened curve of intravesical pressure with a desire to void after the bladder is filled with a large quantity of fluid (figs. 1, 2 and 3).

Whether the surgeon can minimize nerve trauma by keeping the dissection close to the rectal wall is debatable. Bacon reported a low incidence of vesical dysfunction following his operation of procto-



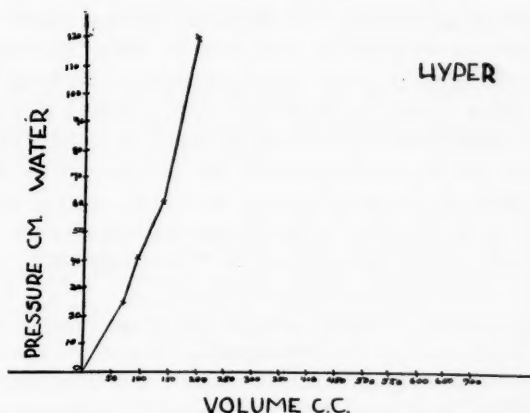


Fig. 2. A hypertonic type of cystometrogram seen in some types of spinal cord pathology and in some cases of vesical pathology.

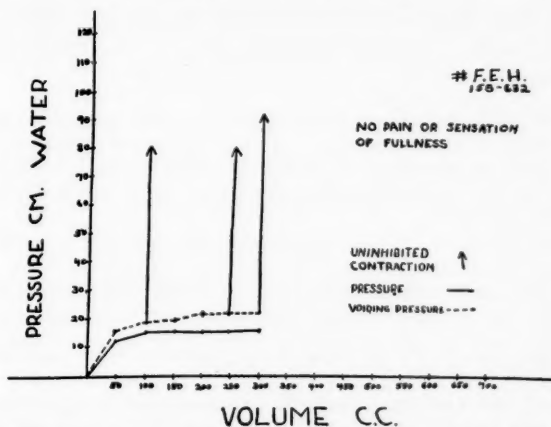


Fig. 3. A hypotonic type of cystometrogram, in this instance due to injury of the spinal cord.

sigmoidectomy, a "pull-through type of operation" with preservation of the anal sphincter, as compared to the Miles operation with the extensive perineal dissection.

There are many students of this subject who do not agree with this neurogenic concept. Several investigators have failed to confirm the cystometric evidence of loss of nerve function in these cases. The nerve injury which occurs is not extensive enough to cause complete denervation of the bladder.

In some of these cases after a transurethral resection the patient will void normally, and there will be no demonstrable evidence of a

residual neurogenic bladder. If nerve injury was the chief cause, then the incidence of retention should be the same in both sexes.

Several writers believe that the chief contributing factors are the changes chiefly mechanical which occur in the bladder and the vesical neck as the result of the loss of its perineal supports. They differ, however, in their conception of how the anatomy of the bladder is altered. These mechanical theories may help explain why vesical dysfunction with retention is less frequent in the female, since the bladder would receive support by the broad ligaments, the uterus and tubes.

The patient with a rather large prostate who develops urinary retention following an abdominoperineal operation will usually regain good bladder function following its removal by prostatectomy or transurethral resection. Such cases would suggest that the presence of a definitely hypertrophied prostate prevents some angulation and fixation of the vesical neck and prostatic urethra.

The presence of distortion, angulation, and fixation of the urethra would not necessarily always produce urinary obstruction as shown in the following case of—

C.R., an 81 year old man we recently observed on whom a diagnosis of carcinoma of the prostate in addition to a carcinoma of the upper rectum was made. There were symptoms of vesical neck obstruction. A biopsy of the prostate at the time of the abdominoperineal operation revealed a carcinoma primary in the prostate.

Postoperatively he was given stilbestrol, and prolonged urethral catheter drainage was employed, after which he still was unable to void. A cystotomy was done, and subsequently a transurethral resection. The urethra was markedly distorted and angulated making the passage of the resectoscope difficult. A large amount of prostatic tissue was removed. The suprapubic sinus promptly closed and he recovered good vesical function.

Campbell and Gislason recently discussed the subject and stated that on the basis of cystoscopic examinations of these bladders, they found that the most common finding was fixation of the bladder wall manifested by lack of mobility as the bladder was passively emptied. They believe this is due to a pericystitis, traumatic in origin, which prevents the detrusor from functioning normally.

These observations in the one case in which they did a suprapubic cystotomy are most interesting and in my opinion add another factor which must be considered in the postoperative management of some of these cases. Undoubtedly, this type of pericystitis occurs more often than we might suppose, and our reason for not seeing it is that cystotomies in these cases are probably not done in most instances early enough to observe these changes.

The pathologic picture described by these observers could pro-

duce the "dome-shaped" bladders seen on cystograms reported by Hill, Barnes and Courville. These deformities were observed to disappear gradually beginning about the twelfth postoperative day. This inflammatory paralysis or fixation of the bladder wall could simulate a neurogenic type of picture and probably produce a neurogenic type of cystometric curve.

F.C.K., a man of 66, had an abdominoperineal proctosigmoidectomy in February, 1949. Pathologic examination of the specimen showed regional lymph node metastases. On the ninth postoperative day a small bowel obstruction necessitated reopening of the abdomen. A Foley catheter was left indwelling following the original operation with intermittent drainage for 12 days. Following its removal there was dribbling and voidings of 3 or 4 ounces and residual urine up to 500 c.c. at times.

A cystometrogram (fig. 4) showed a mixed type of curve.

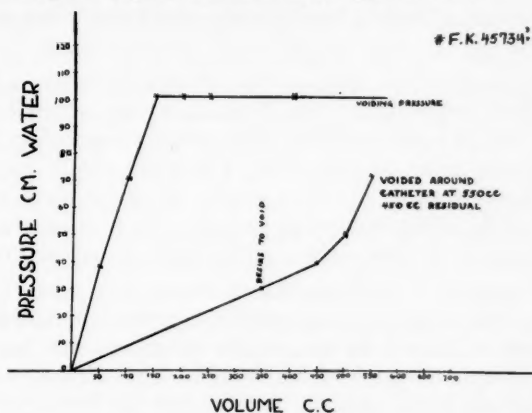


Fig. 4. This is the type of cystometrogram which we usually observe in the cases under discussion and which presents an atypical type of curve.

An infection of the pelvic space with drainage persisted for some time.

Approximately 5 weeks following the proctosigmoidectomy he was cystoscoped, which examination revealed intraurethral lateral lobe hypertrophy. At the time of his original examination his prostate was noted as normal to enlarged, grade I, of a fibrous type with minimal vesical symptoms and only a few cubic centimeters of residual urine.

The urethra was somewhat distorted. Fifteen grams of prostatic tissue were resected. Postoperatively he developed an epididymo-orchitis, and a secondary hemorrhage.

He developed urinary incontinence of the stress type and always carried approximately 75 c.c. of residual urine. Episodes of urinary tract infection occurred. A second resection was done in an attempt to relieve him of his residual and stress incontinence, following which he was improved.

Subsequently roentgenograms of the pelvis revealed changes in the left ileum which were probably due to metastases.

In this case we feel that the postoperative catheter drainage was inadequate. We also feel that the infection of the pelvic space produced a paracystitis. No doubt there was some neurogenic disturbance secondary to paraneural metastases.

Campbell and Gislason observed that, due to the interposition of the female generative organs, operative trauma to the bladder is somewhat minimized and such a pericystitis would be less apt to occur.

They reported 2 cases of prolonged vesical dysfunction in 2 patients after proctosigmoidectomy, both of whom had previously had total hysterectomies. Such a finding also suggests that postoperative urethral catheter drainage probably should be carried on for a longer period of time than we are in the habit of doing, in order to produce complete bladder rest and restoration of normal detrusor mobility.

It is my own personal opinion that urinary retention is probably due to a combination of all the various factors which have been suggested. There is no doubt but that urinary obstruction occurs as a result of neurogenic disturbances. Yet, I am also inclined to believe that some form of obstruction also occurs in these cases and is not discernible or interpreted as such at cysto-urethroscopic examination because of the distortion and fixation of the urethra.

Again in summary I believe that each of these cases of vesical dysfunction following proctosigmoidectomy presents its own particular problem and cannot be assumed to be due to any single cause. Our efforts to restore bladder function should be based on this type of reasoning.

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## IMPERFORATE HYMEN WITH HEMATOCOLPOS

### Case Report

WALTER W. DANIEL, M.D., F.I.C.S.

Atlanta

**I**N 1939 Tompkins<sup>1</sup> assembled from the literature 113 cases of hematocolpos due to imperforate hymen, and he gleaned five cases on the gynecologic service of the University of Pennsylvania in the twelve years ending in 1936. He stated that hematocolpos resulting from an imperforate hymen is neither a new nor a particularly rare condition.

In studying the literature since Tompkins' report I have been able to find only eight cases in the various journals and am adding this case of mine. These were reported by Doyle,<sup>2</sup> Deuterman,<sup>3</sup> Hoerr,<sup>4</sup> Holloway,<sup>5</sup> Keresztrin,<sup>6</sup> Lacal,<sup>7</sup> Bowles,<sup>8</sup> and Bowen.<sup>9</sup>

Of these eight, that of Doyle<sup>2</sup> is extremely interesting: it emphasizes the importance of a complete examination and certain diagnosis before undertaking treatment. The patient was a 13½ year old girl, who had complained of listlessness, fatigue, lower abdominal cramps, nausea and vomiting, over a period of six months. She had never menstruated. She was subjected to a bilateral salpingo-oophorectomy for ovarian blood cysts. In four months her symptoms returned and a hysterectomy was done in spite of the normal appearance of the uterus. During the operation the vagina was opened and a considerable amount of thick chocolate-colored material was encountered. The appendix was then removed and inspection revealed an imperforate hymen. As improbable as this case may seem, there are others where true diagnosis was established by perineal inspection only after unnecessary abdominal surgery.

Among the 113 cases selected from the literature, Tompkins noted that there were six cases in which death resulted and nine in which severe pelvic infections occurred. Of the five additional cases which he reported there was one fatality and an additional case of pelvic infection.

Doyle maintained that there are less than 200 reported cases in the literature. From July 1928 to July 1940, during which time 78,958 patients were admitted, there were only 11 cases of hematocolpos recognized on the gynecologic service of the University of Southern California and Los Angeles County General Hospital. A number of cases have been reported in foreign literature and some dating back as far as 300 years. One (according to Doyle) was reported by Ambroise Pare who diagnosed his case as pregnancy because of the abdominal swelling and pain.

## REPORT OF CASE

A girl of 14 complained of cramping pains in the lower abdomen and of headaches. She had considered herself in perfect health until approximately a year previously, at which time she had begun to suffer from mild cramping spells in the lower abdomen, just above the symphysis pubis. She had never menstruated; it seemed that this cramping occurred about the same time each month. The pains usually lasted one or two days; sometimes they had been severe enough to cause her to go to bed. She also suffered from frontal headaches lasting one or two days practically every week, but always with her monthly cramping spells. With her headaches occasionally she had become nauseated and she had vomited several times. Her condition had become progressively worse during the past year until about four weeks before admission at which time she had had her worst attack. She had begun to feel in her vagina, or where her vagina should be, a soft mass that became progressively larger for two days, obstructing the urethra by pressure, then it began to subside but some swelling persisted. She consulted her family doctor who advised her to enter the hospital for further examination and treatment.

She was a well developed, well nourished white girl. *The Abdomen:* The contour of the abdomen was flat except for a slight dome-shaped bulging in the midline below the umbilicus. Here was outlined a mass that felt like a uterus pregnant four months. Its upper border reached midway to the umbilicus and on each side it extended out about 10 cm. *External genitals:* The labia majora seemed normal in every way. The right labium minor was larger than the left. The clitoris was somewhat larger than normal and was not bound down. The urethra was in a normal position. The meatus was 50 per cent larger than usual and it tended to gap open. No vaginal orifice could be found. Below the urethra was a slight bulging mass; apparently behind this bulge was a liquid under pressure. The bartholin glands were not palpable.

On rectal examination the bulging mass was made out anterior to the rectum. Its consistency was much like that of a large ovarian cyst. The cervix could be dimly outlined at the upper end of the mass. On bimanual examination the uterus could be outlined as normal in size and shape but apparently it was slightly retroverted.

The patient was carried to the x-ray room where a No. 9 catheter was passed with difficulty into the bladder; the urine allowed to drain out and air injected. A needle was inserted through the thick hymenal septum and some 20 c.c. of viscous, chocolate-colored fluid was withdrawn and replaced with a dye substance to outline the vaginal cavity. A roentgenogram outlined the vaginal cavity and showed it to be distended but well outlined. The x-ray served to establish that there was no atresia of the vagina itself and that the removal of the hymenal obstruction would clear the vagina.

That afternoon under sodium pentothal anesthesia, cruciate incisions were made through the thick hymenal ring and 470 c.c. of chocolate-colored, viscid fluid drained out of the vagina. The vaginal mucosa appeared normal and the pressure had apparently done no damage. The cervix was somewhat dilated and viscid fluid was dammed back into the uterus. After the evacuation of this fluid the uterus could be palpated easily; the tubes did not seem to be enlarged or engorged and it was believed that not much of the fluid had been dammed back into the tube area.

The patient had an uneventful recovery and went home on the fifth day. Six weeks later a picture was made by injecting lipiodol into the uterus and it



passed out through the tubes nicely, showing no obstruction of the tubes. It is believed that this girl will have normal function and will be able to produce children when the time comes.

### SUMMARY

Imperforate hymen is clinically important though not common. It is produced by the failure of the centrally located epithelial cells of the posterior wall of the hymen to degenerate. This naturally prevents the mucus and blood from flowing out of the vagina and they begin to dam back producing in order hematocolpos, hemato-trachelos, hematometrius and hematosalpinx. If the hymen is not taken care of one of two things may happen—it may rupture or an infection may occur. This condition must be considered in differential diagnosis whenever amenorrhea is associated with difficulty in urination and pain in the lower abdomen.

The treatment consists of making cruciate incisions to allow the dammed up fluid to run out slowly, then excising the central area and suturing the cut edges. Postoperatively, Fowler's position is desirable.

An illustrative case is reported.

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## SURGICAL TREATMENT OF HYPERTENSION

FRANKLIN JELSMA, M.D.\*

Louisville, Ky.

ALL physicians are concerned with the many serious problems presented by hypertension. All will agree that the present methods of treatment, both medical and surgical, are far from ideal. The fact that the percentage of our population over 50 is rapidly increasing; the fact that nearly 50 per cent of those above 50 have hypertension; the fact that there is at present a rapid increase in the general incidence of hypertension, and that it contributes directly or indirectly to 25 per cent (and some claim 90 per cent) of the deaths of those affected, presents a serious challenge to the many long-established and accepted methods of handling the problem. The medical profession has been hard at work trying to improve matters, while the public at large has become ever more conscious of the gravity of the disease and are less content to abide their time on palliative measures alone. They are presenting themselves earlier, and in many instances are well informed as to their reduced life expectancy and seek aid in their attempt to prolong life.

### GENERAL CONSIDERATIONS

As an answer to this challenge, in the past 10 to 15 years innumerable investigations have been conducted to find out essential facts concerning hypertension. Some progress has been made.

It has been determined that heredity plays an important causative role, that hypertension occurs more frequently in females, and that the stress and strain of modern living tends to increase the incidence, that age and race are factors; yet the *exact* cause of hypertension is still unknown.

An evaluation of the available facts at present would suggest that hypertension is an inherent constitutional disorder resulting from multiple factors. It is true that the humoral mechanism, the neurovascular mechanism and the kidney mechanism all have many supporters. It is true, also, that from a physiologic point of view, in essential hypertension one finds an inherent hypertonus with increased peripheral resistance necessitating an increased force of the heart beat and an elevated pressure to permit the necessary amount of blood to flow through the arterioles.

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\*From the Department of Surgery, University of Louisville School of Medicine, and St. Joseph Infirmary.

## STAGES

Clinically, essential hypertension develops gradually, and as it progresses tends to pass through three poorly defined phases, known as:

(1) The prehypertensive stage. (2) The functional stage. (3) The organic stage.

In the prehypertensive stage, there is a tendency for an abnormal rise in blood pressure on excitement or emotional stress and strain, but the blood pressure returns to normal without any difficulty. In the functional stage, the blood pressure is abnormally elevated on exertion but falls to normal with rest. The patient may complain of tiredness, weakness, tenseness and inability to relax. In the organic stages there are local changes usually manifested in the eyes, brain, heart or kidneys, and the hypertension is relatively fixed. Essential hypertension comprises by far the largest group of hypertensive cases.

## PATHOLOGY

Primary pathology is absent in the cardiovascular and renal systems. With the passage of months or years, with the effects of stress and strain, and physical activity, the blood pressure levels become higher, and the upward fluctuations become more pronounced. Then damage can be found in the retinal vessels, the brain, the cardiovascular and renal systems. These changes may occur slowly or rapidly, but are of a secondary character, the result of hypertension and not the cause of hypertension. Cardiac enlargement, with left ventricular preponderance, diffuse hyperplastic sclerosis of the arterioles, and later thrombosis, may be found. Patchy atrophy of the kidneys with fibrosed glomeruli and atrophic tubules occurs. These are late changes and produce disastrous effects upon the patient.

If the inherent hypertonus producing the peripheral resistance can be altered by interruption of the vasomotor system, it should be done in those cases where surgery is to be employed before the stage of continued hypertension has been reached, or at least before too much secondary pathology has occurred. In this way one can expect to delay the advent of the undesirable pathologic changes and can also expect a more favorable long time prognosis.

## DIAGNOSIS AND TREATMENT

The diagnosis of essential hypertension is seldom difficult. It is arrived at by the exclusion of all other types of hypertension. In other words, it is of asymptomatic origin, while other types are

symptomatic and originate from direct causative pathology, which can be found in the kidneys, heart, vascular system, or elsewhere.

After a definite diagnosis of essential hypertension has been made, I think it is extremely important that treatment be planned and mapped with a full consideration of the basic facts: that the course of this disease is persistent, and that it is insidiously progressive. Consideration of the plans of treatment must be projected over a period of time (much as in the present day consideration of cancer) and everything, both medically and surgically, planned for the patient's relief. A definite classification of each individual in respect to prognosis must be made, and treatment predicated accordingly. Those cases that are to be treated surgically should be selected as early as possible, without procrastination, and not as a last resort. Surgery does not represent the ideal or specific method of treatment, but it does relieve vasoconstriction, with reduction of peripheral resistance and lowering of arterial pressure and associated improvement, subjectively and objectively, of the patient. In the well selected cases, surgery also improves the cerebral, ophthalmic, cardiac and renal status of the patient. Further, it definitely produces a lowering of the diastolic levels, a narrowing of the pulse pressure, a reduction in the ceiling levels after stimulation, and a reduction in the magnitude of reflex responses. It is the best method that we have today of combating essential hypertension.

#### PROGNOSIS

From the viewpoint of the individual patient, the development of criteria, from which a prognosis with surgery can be reasonably established, is highly desirable. It is just as important to be able to conclude that a hypertensive patient cannot be helped, as to conclude that he can be helped by surgery. The state of the brain, eyes, kidneys, heart and arteries, as determined by extensive studies and numerous tests, permits the application of certain criteria known at present to be helpful in selecting cases. The following conditions, under certain circumstances, may be considered as unfavorable to surgical treatment of hypertension:

- 1) Cerebral breaks, such as hemorrhage, or thrombosis.
- 2) Advanced eyeground changes, with papilledema, hemorrhages and exudates, and marked arteriovenous compression.
- 3) Congestive heart failure.
- 4) Impaired kidney function, with elevated NPN, or intravenous PSP output below 15 per cent in 15 minutes, or a urea clearance of below 50.

5) A resting pulse pressure 20 mm. or more greater than one half the diastolic blood pressure.

6) Too advanced age.

In other words, if the patient is not much over 50 years of age, but preferably younger, if there is no evidence of a vascular break in the brain, eyes or heart, and no congestive heart failure, if the PSP is 15 per cent or more in the male and 10 per cent or more in the female in the first 15 minutes, and 50 or more for one hour, the urea clearance 50 per cent or more and NPN not elevated, if there is a good cold pressor response and a good lowering of the blood pressure with Etamon or sedation, if the pulse pressure is equal to or less than one half the diastolic pressure, and certainly not higher than 20 more than one half the diastolic, the patient with essential hypertension can be expected to receive good results from surgery. Individual variations can be made in one or more of the above criteria for selection of suitable cases but the degree of variance is best predicated by the tables of possibilities (suggestions) supplied by Smithwick.<sup>1</sup> We feel that at this time sufficient information has been compiled to permit careful selection of patients for surgery, and exclusion of those upon whom surgery would not be helpful. By following the rules and criteria carefully, a much higher degree of favorable prognosis can be predicated preoperatively, and attained postoperatively. This is certainly more suitable to the patient.

We have used the so-called "general suggestions" and specific criteria as laid down by Smithwick and have carefully selected our patients for surgery. Our results have been very gratifying and contrast markedly with the results we obtained with the supra-diaphragmatic or infradiaphragmatic operations which were used in the thirties before the Smithwick procedure was introduced. Formerly the criteria for selection of patients was not adequate and would not permit as reliable a prognosis as at the present time. Further, the earlier types of operations would reduce the reflex vasomotor variations with improvement of the subjective status of the patient, while the blood pressure was not lowered materially or would not retain a comparable postoperative lower level. Now it seems that by the proper selection of the patients and the utilization of the Smithwick operation, reversal of the cardiovascular damage existing preoperatively can, at least in part, be expected, as well as a subjective improvement in the status of the patient. The blood pressure levels remain lower, the pulse pressure and diastolic pressure are favorably affected in a higher percentage of patients. Improvement in the size of the heart, the electrocardiograms, the eye-grounds and the renal function are commonly noted.<sup>1-4</sup>

## OPERATION

The operative procedure we use is basically the Smithwick operation;<sup>5</sup> however, we have modified it somewhat. The patient is placed on the side with the knees drawn up, with the table broken at the flank. Portions of the eleventh and twelfth ribs are removed, instead of just the twelfth rib. Removal of portions of the eleventh and twelfth ribs gives a little better intrathoracic exposure so that T-8 ganglion can be readily removed, with a corresponding higher section of the splanchnic nerve. A separate incision with resection of a portion of the seventh rib<sup>6,7</sup> will permit more extensive removal of the sympathetic trunk and splanchnic nerve, if desired.

Exposure is made above and below, without splitting the diaphragm. The infradiaphragmatic exposure is made by extending the incision toward the anterior superior spine and proceeding as with the usual abdominal sympathectomy. If for some reason it is especially desired that the reproductive mechanism be preserved, the operation below the diaphragm is omitted on one side entirely. It is not likely that a bilateral operation would render the patient sterile;<sup>1</sup> however, it would be better to leave the lumbar ganglia on one side if such a problem is encountered.

Ordinarily, the sympathectomy extends from the seventh thoracic ganglion down to and including lumbar 2. The greater splanchnic nerve is removed from T-7 down to the celiac ganglion. The lesser splanchnic and splanchnic ima are also removed.

J. W. Hinton and J. W. Lord, Jr.<sup>8</sup> have reported on the results of the classical Smithwick and a more extensive operation and it would seem that, except for special cases, the Smithwick procedure is preferable. It is not certain that more extensive sympathectomies are more effective. On the other hand, the patients are less pleased and there are more untoward results, and a higher mortality. If there is any merit in a more extensive sympathectomy, it may possibly lie in the group of younger individuals under 30 years of age.

Time may materially change our figures, but early results indicate an improvement in 80 to 85 per cent of our group of over 100 carefully selected cases extending from months to six years postoperative. However, as a matter of clarity and emphasis as to the study and selection of cases, I wish to present some data on two typical cases by way of illustration:

CASE 1. Male, aged 47, a known hypertensive for 8 years, with a mean resting blood pressure of 200/110. Cold stimulation gave a ceiling of 235/125, and Etamon intravenously gave a fall of blood pressure to 150/90 (fig. 1). The PSP was 34 per cent in 15 minutes, and 65 per cent in one hour. The NPN was 29. The urea clearance was 84 per cent. The Mosenthal gave a



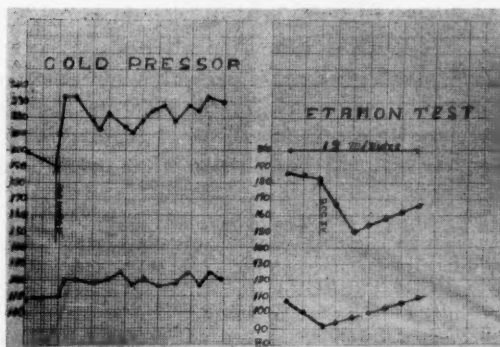


Fig. 1. Water at  $3^{\circ}$  gave a rise of 40 points systolic and 15 diastolic. 2 c.c. Etamon produced a fall of 40 points systolic and 15 diastolic.

variation of 14 points, and the intravenous pyelograms were normal. The electrocardiogram showed left ventricular preponderance. On the heart films the cardiac shadow measured  $13\frac{1}{2}$  cm., the chest  $30\frac{1}{2}$  cm.

A two stage thoracolumbar sympathectomy and splanchnicectomy was performed. The blood pressure response was typical. There was a marked fall to 90/60 immediately after the first operation, but a gradual rise in 24 hours to 150/100, then finally seeking a level somewhat below the preoperative level. After the initial fall to 80/60 following the second operation, it gradually during the next 7 to 10 days reached a surprisingly high stage, while the patient was supine in bed. But it receded slowly, so that around two weeks postoperatively it was 125/80 supine, considerably below the preoperative level. When the patient stood up it fell rapidly and at first it was not possible to register a blood pressure and the patient fainted. Binders with ace bandages about the lower extremities and a Skulletetus binder with a sponge rubber pad over the abdomen maintained a blood pressure of around 100 to

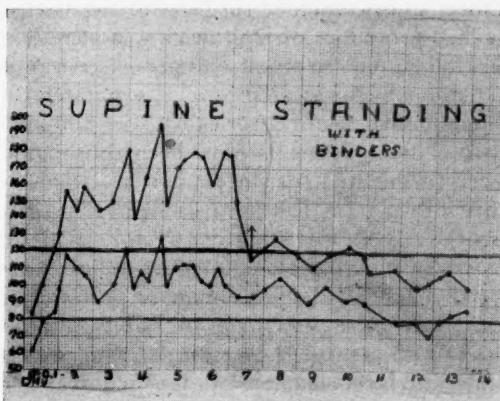


Fig. 2. Contrasting early supine and standing pressures. Supine pressure receded to 125/80 in 14 days.

110 systolic and around 70 to 80 diastolic. It was necessary to wear the binders for four months (fig. 2).

This patient had a higher pulse pressure than one would like in the selection of cases: 35 points greater than one half the diastolic pressure. We chose him because all other factors were favorable. The procedure has certainly been worth while up to date, one year postoperative.

CASE 2. Female, school teacher, aged 47, complaining of weakness, exhaustion, tenseness, difficulty in concentration, headaches and insomnia. Resting blood pressure was 180/110. Cold stimulation gave rise to 230/125 and Etamon intravenously caused a fall to 150/82. The eyegrounds were normal, except for slight venous notching. The basal metabolic rate was +6. The electrocardiogram and intravenous pyelograms were normal. The PSP was 29 per cent in 15 minutes, and 60 per cent in one hour. The NPN was 31, urea clearance 91 per cent, and the Mosenthal gave a range from 1008 to 1028.

A bilateral thoracolumbar sympathectomy and splanchnicectomy was performed in two stages, ten days apart. Nine days after the first operation the blood pressure was 140/95. Immediately after the second operation the blood pressure fell to 110/70 but on the sixth postoperative day it had reached 170/100, and then gradually receded to 120/80 on the sixteenth postoperative day. Binders were needed to maintain pressure and prevent fainting when standing.

This patient resumed school teaching eight weeks postoperatively. There has been none of the former subjective symptoms and a maintained low blood pressure within normal limits to date, a little more than a year.

#### COMMENT

I did not feel that the results obtained in the thirties, by either the supradiaphragmatic or the infradiaphragmatic approach alone were satisfactory, so discontinued surgery for hypertension entirely until the combined procedure of Smithwick was introduced in 1940. Much credit is to be given to those who persisted in their efforts to relieve hypertension by surgical means. Fortunately, a thorough study and complete analysis of a series of over 500 cases has been made from two clinics.<sup>1,9</sup> Results have been thoroughly analyzed. Rules have been formulated for the proper selection of cases. Undoubtedly, this information has been as helpful in getting better results postoperatively as any other one factor. It permits a prognosis preoperatively and allows one to select the cases carefully and thereby materially increase the percentage of postoperative success; and likewise to reduce the percentage of failures. I would like to emphasize the fact that surgery of essential hypertension has been utilized in sufficiently large numbers of cases and over a long enough time now, to permit the establishment of certain rules, and almost laws, for the selection of cases which, if used, will permit a better

preoperative determination of what the results might be postoperatively and thereby allow the surgeon to exclude certain undesirable cases, and by so doing improve the over-all response to surgery. Before such data were available, many operations were done in the hope that results might be obtained. I am aware that some claim that postoperative results cannot be determined preoperatively, but I believe the rules, if followed, will come nearer than any other method of determining the postoperative results. Further, in the malignant stage at times the patient and the physician may feel that surgery offers the only chance and that nothing else will help. It is much better to plan surgery early in the course of the disease and not use surgery as the last resort. When hypertension is discovered, the type of hypertension should be determined and then if, by exclusion of all other types, essential hypertension is found to exist, treatment should be planned, much as in a case of cancer. One must try to answer: what will be this patient's condition in 1, 3, or 5 years? What type of treatment over a period of years will give this patient the best results? Then if surgery is to be utilized, by all means it should be used before permanent damage has occurred in the cardiovascular system, the kidneys or brain. Further, in the late stages, the cases should be thoroughly considered on the basis of not whether the patient can stand surgery, but whether surgery will be worthwhile. We owe the patient more than just the relief of subjective symptoms of headache, tenseness, and fatigue. By planning his course early, perhaps material organic changes can be slowed up to a considerable degree and his active, gainful life prolonged, to say nothing of making him more comfortable and happy.

#### SUMMARY

1. The incidence of essential hypertension is increasing, also a large percentage of these patients die within 3 to 5 years.
2. There is no known causative agent, and no known curative agent available.
3. In proper cases surgery has relieved symptoms by reducing peripheral resistance, improved ophthalmic, cardiac and kidney function, as well as prolonged the useful and active years of life.
4. The use of the criteria and the rules of Smithwick in selection of cases is advocated.
5. A prognosis of each essential hypertensive patient, based on the results of a complete work-up of the cardiovascular system, the kidneys, brain and eyegrounds, is suggested immediately, and if surgery is to be utilized it should be done before permanent organic changes have occurred.

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## NEUROSURGICAL PROCEDURES FOR THE RELIEF OF INTRACTABLE PAIN

CHARLES E. TROLAND, M.D.\*

Richmond

THE relief of intractable pain by neurosurgical procedures is not a recent addition to the physician's armamentarium for the proper treatment of patients. However, recent anatomic and physiologic studies have greatly broadened the scope of this field and have brought almost all intractable pain problems within the horizon of the neurosurgeon. This does not mean that all pain problems are now capable of easy solution, but it does serve notice that the vast majority of sufferers from intractable pain can be benefited now by proper treatment and it is reasonable to expect that within the foreseeable future all such patients can obtain relief.

Just as it is no longer permissible simply to make a diagnosis of cancer and make no attempt to eradicate the neoplasm, so it is no longer proper merely to state that the patient has intractable pain due to cancer and make no attempt to relieve such pain. Fortunately, most patients with cancer do not suffer severe pain, but when such pain does occur it is a distressing addition to an already difficult problem. The simple administration of morphine or other drugs is not the answer to the problem. Of course, patients with an extremely short life expectancy are not candidates for surgery and should have pain relief from drugs alone, but it should always be borne in mind when evaluating pain problems that many seemingly debilitated cancer patients live for long periods of time.

In considering the various procedures for the relief of intractable pain, it is convenient to divide the body into regions as the problems associated with pain relief in the various regions are quite different.

1. *The Lower Thorax, Abdomen and Legs:* The procedure used for the relief of intractable pain below the level of the lower thorax is well standardized. This procedure is known as cordotomy and was introduced by Spiller and Martin<sup>29</sup> in 1912. Spiller,<sup>28</sup> in 1905, had reported the grouping of pain and temperature fibers from one side of the body within the anterolateral column of the opposite side of the spinal cord and Schüller,<sup>27</sup> in 1910, had suggested the possibility of cordotomy. Stookey<sup>30</sup> and Peet<sup>19</sup> have presented excellent

\*From the Department of Neurological Surgery, Medical College of Virginia, Richmond.

Presented before the seventeenth annual Postgraduate Surgical Assembly of The Southeastern Surgical Congress, Biloxi, Miss., May 24, 1949.

reviews of the historical aspects of this most useful operation which has now been widely accepted and has been modified by many workers. The topical arrangement of the pain fibers from different segments of the body in the lateral spinothalamic tract has been extensively studied by Weaver and Walker<sup>38</sup> in monkeys and by Walker<sup>36</sup> in man. These experiments and clinical observations by many others have led to precision in the cutting of the appropriate part of the spinal cord. Peet,<sup>19</sup> in 1926, noted that the anterior segment was of greatest importance in obtaining a high level of analgesia and this concept has been emphasized by Hyndman and Van Epps.<sup>15</sup> Hyndman<sup>14</sup> also has shown that section of Lissauer's tract is of importance in raising the analgesic level. An excellent presentation of the technical aspects of cordotomy was made by Kahn and Peet<sup>16</sup> in 1948.

The results of cordotomy have been published by many neurosurgeons, including Crutchfield,<sup>3</sup> Peet,<sup>19</sup> Sweet,<sup>32</sup> Frazier,<sup>7</sup> Horrax<sup>11</sup> and Hyndman.<sup>13</sup> These results have been excellent with a very high percentage of patients receiving excellent relief of pain and the operative mortality averaging less than 5 per cent. On the Neurosurgical Service at the Medical College of Virginia, 28 cordotomies have been performed during the past three years by the author, Dr. John M. Meredith, and two members of the house staff, Dr. Carroll A. Brown and Dr. James C. Walker. Of these operations, 24 were bilateral and 4 unilateral. In 18 cases there was almost complete relief of pain and in 6 cases there was satisfactory pain relief in that the patients were much more comfortable and rarely needed drugs. In the remaining 4 cases there was good pain relief at first but there was some recurrence. Cordotomy was repeated in 2 cases with excellent results. The definite impression has been gained that all cordotomies, with very few exceptions, should be bilateral procedures.

In spite of the excellent results from the standpoint of relief of pain mentioned above, the operation of cordotomy is not to be undertaken lightly. There is certain to be a considerable hospital mortality following this procedure, as many of the patients are already bedridden because of their neoplasm. In the series here reported there were no operative deaths but 2 patients died in the hospital two and ten weeks following operation. Cordotomy is often accompanied by a painful neuritis in the operative region, lasting for several weeks, and, therefore, the operation should not be carried out unless the life expectancy is longer than a few weeks. Otherwise, there would merely be substitution of upper thoracic pain for the original pain. There is also a possibility of motor weakness following cordotomy and such weakness did occur in 4 of the cases



here reviewed. In all except one of the cases this leg weakness was transitory and in this case there is continuing return of power so that the patient is ambulatory. In all bilateral cordotomies there is temporary loss of ability to empty the bladder. This bladder dysfunction may persist for several months but in the majority of instances (22 of the cases here reported) satisfactory control is regained within three weeks. The operative mortality, postoperative discomfort, temporary bladder paralysis and possibility of neurologic deficit must all be considered in evaluating cordotomy. In truly intractable pain these considerations are far outweighed by the pain relief afforded the vast majority of these patients.

The technic of cordotomy has been reported many times and will be only briefly outlined. The operation is performed in the upper thoracic region, usually at the level of T<sub>2</sub>. Although some neurosurgeons prefer local anesthesia in order that the level of analgesia can be tested on the operating table, the cases here reported were all performed under general anesthesia. It is felt that the incision into the spinal cord can be placed with sufficient accuracy to permit general anesthesia and thus spare these unfortunate patients the ordeal of operation under local anesthesia. The incision into the cord is usually made to a depth of 4.5 to 5 mm. It begins just anterior to the dentate ligament and extends almost to the anterior median septum. As mentioned previously, it is of importance to section the anteromedian fibers if a high level is to be obtained and an attempt to secure such a level should always be made. When bilateral cordotomy is done the incisions into the cord should be made at least two segments apart.

In cases of intractable pain caused by neoplasms of the abdominal viscera, it is absolutely essential to obtain a high analgesic level. As White and Smithwick<sup>41</sup> have emphasized, the pain fibers to these organs travel by way of the sympathetic nerves and may enter the spinal cord at high levels. In one case in the present series only partial pain relief was obtained because of failure to interrupt these fibers. This patient had carcinoma of the pancreas and although the analgesic level obtained (T<sub>4</sub>) relieved somatic pain due to invasion of the parietal peritoneum, he still suffered some visceral pain. In patients suffering visceral pain alone, it would suffice to section only the splanchnic nerves, but the strong probability of later neoplastic extension outside the domain of these nerves makes cordotomy a more feasible procedure.

2. *The Upper Thorax:* In patients having intractable pain strictly limited to the upper thorax, posterior rhizotomy is occasionally of value. Ray<sup>23</sup> has reported favorably on this procedure. In the series

of cases reported here, 2 cases of pulmonary tumor with severe pain in the upper thorax were treated by section of posterior roots  $T_2$  through  $T_6$  with excellent temporary pain relief, but after approximately four months there was some pain recurrence in one case. This recurrence was due to spread of pain into areas not rendered insensitive by operation. The probability of such spread is the greatest objection to more frequent usage of posterior rhizotomy.

3. *The Arm and Shoulder:* This region constitutes the most difficult area in which to obtain satisfactory relief of pain. Unfortunately, the pain of cancer in this region is often extremely severe. One neoplasm causing such severe pain is the apical carcinoma or Pancoast tumor, the first symptom of which is frequently pain in the arm, caused by infiltration of the brachial plexus.

Perhaps the simplest neurosurgical procedure for relieving arm pain is posterior rhizotomy. Ray<sup>23</sup> has been a proponent of this procedure and reported 24 rhizotomies on apical chest tumors with good results. Grant<sup>9</sup> has reported section of posterior roots  $C_3$  through  $T_2$  for brachial plexus pain in 15 cases. In 8 cases there was complete relief of pain but in 5 cases there was some return of pain because of spread to non-anesthetic areas. There were 2 operative deaths. In spite of the good results reported by Ray<sup>23</sup> and Grant,<sup>9</sup> many neurosurgeons do not care to perform rhizotomy and certainly it carries a severe penalty. When all posterior roots to the arm have been sectioned, the extremity is almost, if not completely, useless. All modalities of sensation have been destroyed and although motor power is intact, the limb is really worthless. Following posterior rhizotomy there are also frequently disagreeable paresthesias referred to the deafferented extremity but these sensations are usually short-lived. In the series here reported, posterior rhizotomy for arm pain was performed on three occasions. In two of the cases the painful arm was already useless, due in one case to massive lymphedema following a breast removal and in the other to destruction of part of the brachial plexus by an apical tumor. In both cases the results were satisfactory, one having complete pain relief until death 8 months later, and the other having almost complete relief for the 5 months that have elapsed since operation. The third case was that of an apical tumor with pain confined to the ulnar aspect of the forearm and the ring and little fingers. As it was essential that this patient have a useful hand and he had refused any operation on the brain stem or spinal cord, the 7th cervical through the 3rd thoracic posterior roots were sectioned. There was complete pain relief for 3 months but, unfortunately, the patient was lost sight of at that time. If he survived for a sufficient length of time, he almost surely had some recurrence of pain

due to spread and this probability makes such a limited procedure rarely feasible.

High cervical cordotomy has been strongly advocated by Stooker<sup>30,31</sup> and others<sup>20</sup> for arm and shoulder pain but this procedure has never attained wide usage. Although few statistics are available, it seems that the mortality is quite high and it is apparently difficult to obtain a sufficiently high level of analgesia to relieve shoulder pain. There has been no experience with high cervical cordotomy at the Medical College of Virginia.

Spinothalamic tractotomy at the medullary level was introduced by Schwartz and O'Leary<sup>25</sup> in 1941. Although their first patient had pain caused by carcinoma of the jaw, the procedure was subsequently used for shoulder and arm pain by the same authors.<sup>26</sup> White,<sup>40</sup> Adams and Munro<sup>1</sup> and Crawford<sup>2</sup> have also reported favorably on this procedure. The results of Crawford<sup>2</sup> have been the most impressive reported, whereas Sweet<sup>32</sup> has noted unfavorable results. Medullary spinothalamic tractotomy has been carried out three times by the author with one operative death. In the other two cases, one of carcinoma of the breast with supraclavicular metastases and the other of a branchial left tumor with extension into the brachial plexus, the relief of pain was eminently satisfactory, although not complete, in one case. One patient was comfortable for 7 months and died of extensive metastases. The other patient has had no pain recurrence in the 8 months that have elapsed since operation. The technic used here is essentially that described by Crawford.<sup>2</sup> An incision 5 mm. deep and 3 mm. on the surface was made just cephalad to the upper rootlets of the XI nerve and just below the olive. This level is about 6 mm. caudad to the obex. The three cases here reported were operated upon under general anesthesia but local anesthesia would be preferable in order to test the analgesic level obtained. Additional experience with this procedure may make local anesthesia less necessary, as has been the case with thoracic cordotomy. Bilateral medullary spinothalamic tractotomy does not seem feasible in the present state of our knowledge. The proximity of vital nuclei to the pain fibers from the arm and shoulder, which are the most deeply placed of the spinothalamic fibers and must be sectioned in order to obtain a good result, make it probable that this operation will always be attended by a considerable mortality. However, it is definitely indicated in some cases and will undoubtedly come into wider usage if further experience duplicates the excellent results of Crawford.<sup>2</sup>

Section of the spinothalamic tract at the pontine level was introduced by Dogliotti<sup>3</sup> who reported 4 cases with 1 operative death.

In 1942, Walker<sup>34,35</sup> reported section of these fibers in the mesencephalon with good results. There has been no experience with these procedures at the Medical College of Virginia and it is believed that suitable cases are relatively rare.

4. *The Face and Neck:* In relief of intractable pain in the face and neck, rhizotomy is of supreme value. In 1926, Fay<sup>6</sup> reported section of the glossopharyngeal nerve combined with upper cervical posterior rhizotomy in a case of carcinoma of the throat. Dandy,<sup>4</sup> in 1929, sectioned the trigeminal and glossopharyngeal nerves with excellent pain relief. Grant<sup>8</sup> and others have reported additional cases of section of the V and IX nerves combined with section of the upper posterior cervical roots with good results. More recently, Grant<sup>9,10,39</sup> has advocated section of the descending tract of the V nerve in the medulla rather than cutting the root at the pons and has exhaustively studied cases of trigeminal medullary tractotomy.

In five instances of carcinoma of the face or throat with extension into the neck, the V and IX nerves and the upper four posterior cervical roots have been sectioned, with one hospital death. In four cases the pain relief was complete at first, but in two cases there was some pain return. In one of these cases, there was pain return only after 7 months of complete freedom from pain, and such return was probably due to intracranial spread of the neoplasm. The other case was that of a confirmed drug addict, and it was extremely difficult to assess his complaints. In three cases trigeminal medullary tractotomy was substituted for section of the trigeminal root with excellent results. These cases have been followed for 9, 7 and 4 months. These results confirm the reports of Grant,<sup>8</sup> but are at variance with Sweet,<sup>32</sup> who reports a 40 per cent mortality and incomplete pain relief. It is the conviction of the present author that section of the pain fibers of the trigeminal nerve, whether this be accomplished by section of the sensory root or medullary tractotomy, combined with section of the glossopharyngeal nerve and the posterior roots of the upper four cervical nerves is an eminently successful procedure and is preferable to all other measures for relief of pain in the face, throat and neck. The impression has been gained that trigeminal root section is preferable to medullary tract section as a surer procedure for complete pain relief. It should be mentioned that in order to make certain that all pain fibers from the throat are sectioned, it is essential to cut the two or three anterior fibers of the vagus nerve. These fibers may actually be only a portion of a bifid glossopharyngeal nerve but it is probable that some pain fibers are really in the vagus nerve.

5. *Cerebral Procedures for Pain Relief:* Mahoney,<sup>17</sup> in 1944,

reported the removal of the post-central cortex in the treatment of painful phantom limb but later noted that this patient had a recurrence of the painful sensation. Horrax<sup>12</sup> and others have also had experiences with this procedure. The present author has excised the post-central cortex in only one patient, a case of phantom arm. In this instance there was immediate complete pain relief with disappearance of the phantom but there was later some return of pain. However, the patient still feels that she has had marked, if not complete, pain relief. The greatest hindrance to complete success with this procedure is the widespread distribution of the sensory cortex. Although the majority of the sensory fibers have their end stations in the post-central cortex, it is certain that sensation is represented over a much wider cortical area. This was readily shown in the one case here reported as stimulation of the motor cortex reproduced some of the phantom pain. It is planned to excise both the appropriate motor and sensory areas if cortical excision is attempted on other patients. It is most improbable that excision of the sensory cortex will have any place in the treatment of the intractable pain due to cancer, although it may well be of value in the so-called "central pain" following cerebrovascular accidents.

Watts and Freeman,<sup>37</sup> Poppen,<sup>22</sup> Otenasek<sup>18</sup> and others have used bilateral prefrontal lobotomy for the relief of pain and have noted good results. This procedure has been carried out on only two occasions on the Neurosurgical Service at the Medical College of Virginia. Both of these cases might truly have been classified as desperate, one of them having intracranial extension of a tumor beginning behind the left ear and the other having multiple metastases from an adenocarcinoma of the colon. Both cases can be said to have been qualified successes as the patients did not complain of pain during their remaining days but were reduced close to a vegetative state. As Watts and Freeman<sup>37</sup> have stressed, lobotomy alters the individual's reactions to pain without materially changing his ability to feel pain. It seems most proper to abolish the pain itself, whenever feasible, rather than to alter the reaction to such pain.

Scarff<sup>24</sup> has recently introduced unilateral prefrontal lobotomy for the relief of pain, advocating this lesser procedure in order to minimize the personality changes following lobotomy. He has reported 10 cases, with good results in 7 of these patients. Vogel and Hjartarson<sup>33</sup> have also noted good results in 8 patients. In the present series, two unilateral lobotomies have been carried out. In one patient with intractable pain associated with carcinoma of the esophagus, the result was perfect, the patient being free of pain until his death 5 months later. In the other instance, a case of testicular tumor with widespread metastases, the result was far less brilliant,



although the patient was much more tractable and needed far less drugs. More experiences with unilateral prefrontal lobotomy will have to be reported before the efficacy of the procedure can be evaluated.

Topectomy, the removal of cortical areas 9 and 10, as reported by Pool,<sup>21</sup> was carried out on a patient with a malignancy of the throat. This procedure undoubtedly gave some relief of pain, but the constitutional inadequacy of the patient and the fact that the patient was receiving irradiation therapy makes it difficult to evaluate the result obtained. Because of the magnitude of this procedure it is doubtful if it will find wide usefulness in the control of intractable pain of cancer.

#### DISCUSSION

Although the number of cases here reported is not large, a review of these cases and a perusal of the available literature has led to certain very definite convictions. A matter of first magnitude is the fact that all too few sufferers from intractable pain are afforded relief by the best available means. It is obvious that all such patients are not candidates for operative procedures, but it is equally obvious that all too few of these unfortunate people are afforded pain relief. One reason for the failure of physicians to refer patients for the operative procedures for pain relief is the general lack of awareness of a large section of the profession as to the efficacy of the available pain-relieving measures, but an equally potent reason is the laissez-faire attitude all too frequently adopted in the presence of inoperable cancer. In the patient with a very short life expectancy, narcotic pain therapy is certainly justified, but in the patients with months or longer to live, the available drugs frequently lose their potency and drug addiction is added to the already difficult problem. Such addiction not only adds to the miserable status of the patient but makes care by the relatives almost impossible.

Of almost equal importance to the awareness of the physician as to the availability of pain-relieving neurosurgical procedures is his understanding of the hazards and possible complications of such procedures. The relatives of the patient must be thoroughly schooled in all features of the case at hand. In particular, it must always be stressed that the operation is intended solely as a pain-relieving measure, is not an attack on the neoplasm and will not prolong the patient's life. The hazards of operation, as regards mortality and such factors as temporary bladder paralysis, must always be well understood by everyone dealing with the patient in any case. In the presence of truly intolerable pain, such hazards are almost always gladly accepted.



The optimum time for undertaking the procedures for the relief of intractable pain is early in the course of such pain. As soon as the diagnosis of an inoperable neoplasm is made and the patient begins to have pain, he should have proper attention to such pain. This usually means that the patient is taking steadily increasing doses of codeine but has not been given much, if any, morphine. There are no advantages in waiting until the patient is bedridden and receiving large doses of narcotics.

As far as the operation itself is concerned, an attempt should always be made to render analgesic not only the region painful at the time of operation but also those areas into which there might well be spread of pain. This simply means that a high level of analgesia should always be sought in cordotomy, numerous roots must be sectioned in rhizotomy and cervical rhizotomy should usually be added to trigeminal and glossopharyngeal nerve section. The neurosurgeon usually has only one opportunity to aid these patients and he must attempt to make analgesic all usual areas of pain spread if a permanently satisfactory result is to be attained.

It is also concluded that prefrontal lobotomy or other cortical operations do not represent the best answer to the problem of intractable pain. Certainly some cases do need this type of treatment but, as previously mentioned, it seems much more logical to attack the pain itself rather than the patient's reactions to such pain.

Certainly with the advance of neuroanatomic and neurosurgical knowledge, many more patients will become candidates for relief of pain with a diminishing toll in mortality and disagreeable sequelae.

#### SUMMARY

1. The neurosurgical measures for the relief of intractable pain are presented and a number of treated cases reviewed.
2. An attempt has been made to evaluate the available procedures.

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## SURGICAL TREATMENT OF PROTRUDED INTER- VERTEBRAL CERVICAL DISC

WALTER G. HAYNES, M.D., F.A.C.S.

Birmingham

THE syndrome described by Murphy,<sup>1</sup> Spurling<sup>2</sup> and others,<sup>3,4</sup> is being encountered with increasing frequency. One is led to the conclusion that the many formerly intractable cases of brachial neuralgia and anterior scalene syndrome must have had as their basic pathology a protruded intervertebral cervical disc. The high incidence of lumbar discs is well known by now and it is the purpose of this paper to point out the fact that a protruded intervertebral cervical disc is almost as commonplace. The author has a series of some four hundred operated protruded intervertebral lumbar discs and contrasting with that has a series of one hundred protruded cervical discs, half of which have been operated upon. This would lead one to the rough conclusion that a cervical disc is one eighth as frequent in occurrence as a lumbar disc.

The treatment of brachial neuralgia has been difficult and has been divided among the many specialties. Only in 1941 did it become generally known among neurosurgeons that a ruptured cervical disc would cause neck, shoulder and arm pain and that removal of such a disc was feasible. Dr. Spurling in 1944 reported a series of seventeen surgically treated patients suffering from cervical discs and his brilliant exposition did much to pave the way for the popularity which has followed among the profession.

There is little to add to the description of the syndrome given by Spurling and by Murphey. The etiology of a ruptured cervical disc is the same as that of a lumbar disc, usually traumatic. It may be based, however, upon a congenital weakness in the embryologic fusion of the annulus fibrosus posteriorly. However, almost all of the cervical disc patients have given a story of having had either a blow on the head or a sudden snap of the neck. Very rarely is there a story of sufficient trauma to cause an actual fracture. The symptoms of the cervical disc syndrome are those of pain upon motion of the neck. It is referred down the shoulder to the arm, usually following the distribution of the radial nerve, into the index finger or the thumb. The pain is made worse upon motion of the neck and may be reproduced by Spurling's maneuver. This test consists of pressure upon the head and inclination of the head toward the affected side. This, of course, narrows the intervertebral foramen thus causing pressure between the nerve root and the ruptured disc.

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Read before the seventeenth annual Postgraduate Surgical Assembly of The South-eastern Surgical Congress, Biloxi, Miss., May 23-26, 1949.

Associated with this pain, which is severe, constant and aching, there is anesthesia, or hypesthesia, of the skin supplied by the nerve roots involved. It has been found that the cervical discs are most prone to occur at the level of C-5 and 6, that is, the sixth cervical disc, or between C-6 and 7, or the seventh cervical disc. The anesthesia resultant from pressure upon the root emanating from between C-5 and 6, or the sixth cervical root, causes hypesthesia at the base of the thumb and the base of the index finger on the dorsal surface of the hand. The radial nerve is tender to palpation and the triceps reflex may be diminished. Compression of the seventh cervical nerve root between C-6 and 7 causes anesthesia, or hypesthesia, at the tip of the index finger on the dorsal surface and may cause diminution of the triceps reflex.

Lumbar puncture may show an alteration of the spinal fluid protein, but since the protrusion of the disc is small this is the exception rather than the rule. Radiopaque substances have been injected into the subarachnoid space and roentgenograms may reveal an indentation of the normally smooth contour of the subarachnoid space at this level. This again, however, is not wholly reliable and the author is more prone to follow the dictates of his clinical impression. Flat roentgenograms of the cervical spine should include oblique views. These delineate the intervertebral foramina and at the level of the ruptured disc one frequently finds an osteophyte, or spur, partially occluding the intervertebral foramen. This is considered diagnostic of a disc at that level.

The author has found that protruded intervertebral cervical discs are made up of two types. One may be the usual pulpy, extruded mass of nuclear material which is soft and which is more easily removable. The other type of disc encountered at operation is that of a hard, calcified ridge. This apparently represents a long-standing ruptured disc which has become calcified or which may even represent merely an arthritic ridge localized to this level. In any event, either protrusion compresses the nerve root and causes the identical syndrome. Both conditions to the author's mind are surgical and both may be relieved by the identical procedure. It is necessary, however, in the case of the hard ridge, or so-called hard disc, either to undercut the nerve root with a small dental chisel, thus relieving the pressure on the nerve, or to unroof the intervertebral foramen allowing the nerve root more room and disregarding the hard protruding ridge. In either case the results seem to be identical. The presence of a pulpy, or soft ruptured disc may be suspected when the pain seems to be more acute and severe as contrasted to the long-standing, chronic story of dull pain usually given by those patients harboring a hard calcific ridge.

The surgical treatment of a protruded intervertebral cervical disc has been so refined that it does not constitute a hazard beyond the usual accidents and complications of any surgery. The operation may be performed under local anesthesia, but traction upon the swollen and inflamed nerve root is invariably painful. For that reason the author prefers endotracheal general anesthesia. The position of the patient precludes the use of pentothal, or other types of general anesthesia unless there is positive pressure available. The patient's respiration is thus always under control regardless of irregularities which might be induced from manipulation of the cervical spinal cord.

The patient is in a prone position with his head in a cerebellar head rest. A small linear midline skin incision is made extending from the spinous process of C-4 to C-7. This is carried down to the spinous processes. The muscles on the affected side are then stripped from the laminae by subperiosteal dissection and a hemilaminectomy retractor is then inserted. This allows adequate unilateral exposure of the laminae of C-5, 6, a portion of C-4 and a portion of C-7.

The lamina on the affected side of C-6 is then removed by means of a Raney or Kerosin punch. A bit of the superior lamina of C-7 is also removed as is a bit of the inferior lamina of C-5. This allows visualization of both interspaces between C-5 and 6 and C-6 and 7. Cotton patties are then inserted to force the dura medially and the involved nerve roots are retracted medially and the interspace inspected. There is almost always a large plexus of dilated epidural veins at this point, some of which may be ruptured. Coagulation of these bleeding points is impractical because of stimulation of the cervical spinal cord. Accordingly, gelfoam or fibrin foam must be used to cause hemostasis. The white glistening dome-like protrusion of a soft, pulpy ruptured disc is easily identified lying just under the nerve root and causing compression of the nerve roots. This disc is easily removed by incising the posterior longitudinal ligament and, by means of a disc ronguer, the extruded material is removed in one piece. It is found in many of these cases that the disc is not soft and pulpy but is hard and cannot be removed by the disc ronguer. The nerve root is retracted medially and the ridge is actually chiseled away by means of a small dental chisel. If this is impractical because of dilated epidural veins, and it frequently is, the removal of the lamina is continued laterally to unroof the intervertebral foramen, sparing the facets. This is not a difficult procedure, although sometimes it is necessary to use the small chisel for this purpose. It can then be seen that the involved nerve is freely movable and no longer is compressed by the arthritic, or bony ridge.

Hemostasis is obtained by the usual means of gelfoam, fibrin



foam, muscle implants and hot water and the wound is closed in layers of fine black interrupted silk.

The patient usually has an uneventful convalescence and when he awakens the arm pain is usually gone. There remains some residual mild pain about the neck, although this disappears in from three to four weeks. There has been no need for bracing the neck after such an operation. The patient is allowed up on the sixth day and home on the seventh day and usually is allowed to return to his former work in about three or four weeks.

There have been no fatalities in this series of cases, and there has been only one complication. That complication consisted of a hemiparesis, accompanied with pyramidal tract signs of increased reflexes, on the same side as the disc. The hemiparesis followed by two weeks the operation for removal of the disc. Spinal puncture failed to reveal any block or alteration in spinal fluid protein and the wound was not reopened. The hemiparesis cleared up within three months and at the present time is not noticeable. It is assumed that undue trauma to the spinal cord caused this.

The end results of such operative interference seem excellent and to the author's mind the operation for removal of a protruded intervertebral cervical disc gives better results by far than the operation for removal of a lumbar disc. As a matter of fact, without exact compilation of results, there have been but three patients who have not had complete relief of their brachial neuralgia. These three patients are considerably better and would be classified as showing marked improvement, but they are subject to residual, recurrent, dull, aching pain in the arm during weather changes or following undue exertion. Because of the lack of weight-bearing, there has been much less residual local pain about the neck than there is following the removal of a lumbar disc.

All in all, the author considers the operation to be a decidedly effective one. It can be recommended without hesitation because of the low mortality and the low incidence of complications, as well as the high incidence of favorable results.

#### SUMMARY

1. There has been reported a series of protruded intervertebral cervical discs. It is pointed out that their frequency is as one to eight compared to lumbar discs.
2. The syndrome has been discussed and the methods of diagnosis established.
3. The operative procedure has been described.

4. The lack of mortality rate and the low incidence of complications and residual pain make this procedure a favorable one.

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## ARTERIAL ANEURYSMS

BARTON McSWAIN, M.D.

WALTER DIVELEY, M.D.

Nashville, Tenn.

**T**HE word "aneurysm" is derived from the Greek verb meaning "to widen." In common usage the word now is applied to a sac which is filled with liquid or clotted blood or both and is in communication with the lumen of an artery. Some authors, in discussing the subject of aneurysms, include instances of arteriovenous fistulae and cirroid aneurysms. In this article only arterial aneurysms will be discussed.

### INCIDENCE

*Race.* Aneurysms are relatively more common in negroes than in white people because of the greater likelihood of trauma by bullet or knife and also because of the higher incidence of syphilis.

*Sex.* Aneurysms occur much more frequently in males than in females because of the higher incidence of arteriosclerosis and the greater likelihood of trauma.

*Age.* Although traumatic aneurysms may occur at any age, other types of aneurysms occur more frequently after middle age.

*Site.* Excepting the thoracic aorta, the arteries of the lower extremity, especially the femoral and popliteal arteries, are more frequently involved by aneurysms than are those of the upper extremity, trunk, head or neck.

### TYPES

*True.* The true aneurysm is one in which one or all of the coats of the artery compose the aneurysmal sac. It is extremely rare, except in very small aneurysms, for example, an aneurysm of the middle cerebral artery, for all three coats of the artery to be present in the sac. Nearly always the media is absent.

*False.* The false aneurysm is one in which none of the three coats of the artery is present in the sac. The wall is composed of connective tissue and blood clots. It is possible that endothelium may line the sac in false aneurysms which have existed for long periods of time.

Except for the terms fusiform, saccular and dissecting, the

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From the Department of Surgery, Vanderbilt University School of Medicine.

Read before the seventeenth annual Postgraduate Surgical Assembly of The South-eastern Surgical Congress, Biloxi, Miss., May 23-26, 1949.

meanings of which are obvious, further classification of aneurysms seems unnecessary and confusing. The only other descriptive terms to be applied herein to aneurysms are those relating to their cause.

#### CAUSES

The causes of aneurysms are trauma, syphilis, arteriosclerosis and inflammation. In some aneurysms none of these etiologic factors is detectable and such aneurysms must be called spontaneous.

*Traumatic.* Even in civilian hospitals, injury is the most frequent cause of aneurysm. Some of the traumatic agents, in order of descending frequency, are bullets, knives, scissors and needles.

*Syphilitic.* Although it is the most common cause of aneurysms of the thoracic aorta, syphilis is an uncommon cause of aneurysms of the peripheral arteries. Even if the Kahn or Wassermann is positive in a patient with an aneurysm in a peripheral artery, it is likely that some factor other than syphilis, usually arteriosclerosis, is the cause of the disease of the artery which leads to the formation of the aneurysm.

*Arteriosclerotic.* Weakening of the wall of an artery by arteriosclerosis is a fairly common cause of aneurysm. A fact which confirms this statement is the ages of occurrence of aneurysms other than those caused by trauma. It is possible that alcohol and tobacco are contributory causes to arteriosclerosis and it is certain that hard labor is an etiologic factor.

*Mycotic.* Although the word "mycosis" is derived from the Greek word meaning fungus, "mycotic" is defined not only as pertaining to a mycosis but as a condition caused by vegetable micro-organisms. Mycotic aneurysms, or those due to inflammation from bacteria, are quite rare.

*Spontaneous.* In some instances, none of the above causes is found and it is necessary to call such aneurysms spontaneous. It may be that so-called spontaneous aneurysms are caused by arteriosclerosis which is not detectable by physical examination.

#### SYMPTOMS

Unlike the objective manifestations, the subjective manifestations of aneurysms are not characteristic. In nearly all instances pain is present and, except in intrathoracic and intracranial aneurysms, usually a mass has been noted by the patient. There may be symptoms of circulatory deficiency, such as intermittent claudication, coldness, numbness, pallor, cyanosis or even gangrene of a part of an extremity. In aneurysms of the thoracic aorta, rupture may be

the first manifestation. In aneurysms of the peripheral arteries, rupture may occur before admission to the hospital but nearly always the pain and mass have been noted previously.

#### PHYSICAL SIGNS

The four characteristic signs of aneurysms are mass, expansile pulsation, thrill and bruit.

*Mass.* In nearly every patient except those with intracranial and intrathoracic aneurysms there is a palpable mass. In a patient without a palpable mass, an area of increased density may be seen by fluoroscopy or on the roentgenogram. Usually palpation reveals a mass which is smooth and oval or spherical. It may be somewhat movable in all directions except longitudinally along the course of the artery. It may be fluctuant but it may be so tightly filled with blood or clot that it feels firm or even hard.

*Pulsation.* Expansile pulsation is the diagnostic sign of arterial aneurysm. This pulsation in the mass is synchronous with the arterial pulse and is present in the majority of patients with aneurysms but it must be differentiated from transmitted pulsation. In some instances there is pulsation which is not expansile and in a few there is no pulsation. Whether there is present expansile pulsation, non-expansile pulsation or no pulsation, depends upon the amount of filling of the sac with clot. If it is partly filled, there may be non-expansile pulsation and if it is completely filled, there is no pulsation whatever. If compression of the artery proximal to the sac causes cessation of pulsation and diminution in the size of the mass, the diagnosis of aneurysm is definitely established.

*Thrill.* A thrill is present in some individuals but its presence was recorded in less than one-third of our patients.

*Bruit.* A bruit may be heard in the majority of aneurysms. The bruit is usually systolic in time, rough or harsh, and it is usually audible only over the aneurysm and not for long distances proximal or even distal to the mass. Pressure on the artery proximal to the sac causes cessation of pulsation and the disappearance of the sound unless there is a large collateral circulation entering the sac.

*Signs of Inflammation.* Usually aneurysms are not tender but occasionally tenderness may be present. This sign is likely to be present if an aneurysm erodes enough tissue to make it become very superficial. In addition there may be redness of the skin and increased local heat. Thus at times the four cardinal signs of inflammation may be present and the mass erroneously diagnosed as an abscess.

## ROENTGENOLOGIC FINDINGS

The x-ray examination may aid in the diagnosis of aneurysms of the thoracic and abdominal aorta and of the innominate and subclavian arteries. An area of increased density may be revealed by the fluoroscope or the film, expansile pulsation may be noted under the fluoroscope and calcification may be seen in the wall of the aneurysm.

## DIAGNOSIS

The diagnosis of aneurysm is usually easy to make. In the presence of a mass which exhibits expansile pulsation, a palpable thrill and an audible bruit, in which, upon obliteration of the artery proximally the mass decreases in size and the pulsation, thrill and bruit disappear, the diagnosis of aneurysm is obvious. However, many of these signs may be absent. Aneurysms have been mistaken for lipomas, sarcomas and abscesses and, following attempted excision or incision, fatal hemorrhage has occurred. The possibility of aneurysm should constantly be kept in mind in the presence of a mass in the region of an artery.

## THE LIGATION OF ARTERIES

In individuals with normal circulation, certain arteries may be ligated with little possibility of the occurrence of necrosis of the tissue to which they supply blood, but ligation of certain other arteries is often followed by necrosis. In individuals whose arteries are affected by disease such as arteriosclerosis, gangrene may follow

TABLE I

<i>Little Possibility of Necrosis</i>	<i>Great Possibility of Necrosis</i>
External carotid	Common carotid
Splenic*	Internal carotid
Inferior mesenteric	Thoracic aorta
Innominate	Abdominal aorta
Common iliac	Hepatic
Internal iliac	Renal
Subclavian	Superior mesenteric
Radial	Axillary
Ulnar	Brachial
External iliac	Common femoral
Deep femoral	Popliteal
Superficial femoral	
Anterior tibial	
Peroneal	
Posterior tibial	
Dorsalis pedis	

\*Unless ligated close to spleen.



ligation of arteries which, in the normal individual, could be ligated without danger. On the contrary, in a patient with an aneurysm the collateral circulation may have developed to such an extent that an artery may be ligated without danger while in the normal individual gangrene might have occurred. Table I classifies some of the arteries as to whether there is little or great possibility of necrosis following their ligation.

#### OPERATIVE PROCEDURES

The choice of operative procedure depends primarily upon whether or not the involved artery may be sacrificed without impairing the blood supply of the tissue supplied by that artery. If the artery is not essential for the nutrition of the tissues, complete aneurysmectomy is the procedure of choice. If the artery is essential, every effort should be made to preserve it and, if it cannot be saved, every effort should be made to preserve the collateral circulation. We believe that complete aneurysmectomy is not the best operation for aneurysms of essential arteries unless their continuity can be re-established by end-to-end anastomosis, with or without some type of graft.

Proximal ligation, either near or at a distance from the aneurysm, may result in failure to cure the aneurysm or in gangrene of a part of the extremity. In order for such a procedure to result in cure of the aneurysm without the occurrence of gangrene, the collateral circulation must be so little that it will not prevent clotting in the aneurysmal sac but yet extensive enough to prevent gangrene. Although the operative procedure is simple, it should never be done except for certain intracranial aneurysms.

Proximal and distal ligation may result in failure to cure the aneurysm and is even more likely to result in gangrene than is proximal ligation.

Reconstructive or restorative aneurysmorrhaphy is the ideal procedure but it can be done only in the minority of patients.

In the majority of aneurysms of essential arteries, excluding the aorta and intracranial arteries, obliterative aneurysmorrhaphy may be done successfully. We believe that, when possible, the tourniquet should be used during operations upon aneurysms. Before the sac can be opened, it is necessary to control the arteries entering and, usually, those leaving the sac. Therefore, there must be accomplished temporary occlusion of the main artery proximal and distal to the sac and of the arteries communicating with the sac. Then the sac may be opened and the arteries communicating with the sac obliterated by suture either inside of or outside of the sac. This pro-

cedure may be carried out with or without partial excision of the sac. If there is excess sac which can be removed without injury to the collateral circulation or adjacent nerves, we believe that it should be excised. Sympathetic ganglionectomy was not done in any of our patients.

We have observed numerous symptomless arteriosclerotic aneurysms of peripheral arteries which have not required operation.

#### POSTOPERATIVE TREATMENT

In the postoperative care of extremities in which the circulation may have been impaired by operation upon the arteries there are certain measures which may be employed to help save the extremity.

Experimental work by Brooks and Duncan<sup>1</sup> showed that tissues of questionable viability are more likely to survive at low than at high temperatures. Nevertheless, usually an electric light cradle or hot water bottle is still used upon such tissues. Such measures increase the metabolic needs of the tissues, thereby leading to early necrosis, whereas cooling the tissues decreases their metabolic requirements and increases their chance of survival until the collateral circulation has become adequate. Therefore the statement is justified that never under any circumstances should the involved extremity be heated above room temperature. We believe that the optimum temperature for such tissues is about 70° F. Although cooling the extremity below 70° F. still further decreases its metabolic requirements, its possible beneficial effect is obviated by the production of vasospasm.

The position of the extremity is extremely important. In dealing with arterial disease of all types one must take advantage of the law of gravity; hence such an extremity should never be elevated except for very short periods of time because elevation makes it necessary for the blood to run uphill. The fullest advantage of the law of gravity to get blood to the toes is taken by permitting the patient to stand. However, because in standing the venous return is diminished, it is not the position of election. We believe that the best position for the lower extremity is obtained by elevating the head of the bed (not just the trunk) a few degrees. For the upper extremity the trunk should be elevated by a low back rest with the arm at the side of the patient.

Although the beneficial effect of Buerger's exercises upon thromboangiitis obliterans is well known, it is not universally known that similar pumping motions are beneficial after operations upon arteries which have rendered the blood supply of the extremities inadequate. The extremity is elevated to drain the blood from the

vessels, lowered to permit ingress of blood to be supplemented by the force of gravity, then placed in the position of election and then the procedure repeated. The extremity may be elevated for 1 minute, then hung off the bed for 3 minutes, then placed in the position of election for 3 to 5 minutes. The angle to which the extremity should be elevated and the length of time during which it should be elevated and lowered are determined by observation of its blanching and flushing. Inasmuch as the blood supply of an extremity is poorest immediately after ligation of the artery and improves every minute thereafter, every effort should be made to keep the tissues viable during the immediate postoperative period because if they survive that period, subsequently the collateral circulation may become adequate. Therefore the exercises should be used continuously for 24 or 48 hours or until it is certain that the blood supply is adequate or until gangrene has occurred.

Immobilization of such an extremity should never be done. One reason for this statement is that the exercises described promote the formation of collateral circulation and aid in pumping blood to the extremity. Furthermore, since blood cannot flow from an area of low pressure to one of higher pressure, it cannot flow into the tissues which are in contact with the bed. Hence, these tissues become necrotic and decubitus ulcers occur.

### RESULTS

The results of our treatment of aneurysms at the Vanderbilt University Hospital have been reported in detail elsewhere.<sup>2</sup> The mortality of such operations upon the peripheral arteries is low, there having been only one operative death in our 26 patients. Subsequent to operation upon the aneurysm, amputation of the lower extremity was necessary in three instances. Follow-up studies revealed that there was no recurrence of an aneurysm and that the function of the extremities was fairly good or good in all of the patients.

### SUMMARY

The incidence, causes, clinical manifestations, operative and post-operative treatment of aneurysms and the results thereof have been discussed.

### CONCLUSIONS

1. The preferable operative procedures upon aneurysms of essential arteries are restorative or reconstructive aneurysmorrhaphy or obliterative aneurysmorrhaphy with or without partial excision of the sac.

2. In the treatment of aneurysms of large arteries, proximal ligation, proximal and distal ligation, or complete aneurysmectomy should not be done if cure is possible by any other operative procedure. However, if, after complete aneurysmectomy, the continuity of the artery can be reestablished by anastomosis with or without some type of graft, such a procedure should give excellent results.

3. In the treatment of aneurysms of arteries which may be sacrificed without jeopardizing the tissues they supply, complete aneurysmectomy is the operation of choice.

4. Following operation upon arteries, if there is any question about the adequacy of circulation:

- a. The limb should never be elevated for a long period of time.
- b. Hot water bottles should never be applied to the limb.
- c. An electric light cradle should never be used over the extremity.
- d. The exercises herein described should be used.

5. In the management of extremities with any type of arterial disease, the limb should never be kept elevated or immobilized and heat should never be applied to the affected limb.

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## EPIDERMOID CARCINOMA OF URETER

### Report of a Case

J. ULLMAN REAVES, M.D.

ANDREW D. HENDERSON, M.D.

Mobile, Ala.

THE increased frequency with which reports of primary carcinoma of the ureter have appeared in the medical literature during recent years is probably due to the marked progress in technic of urologic diagnosis, together with a tendency toward more frequent and careful autopsies, and does not indicate an actual increase in the frequency of the condition. The small number of cases reported have a wide variation in pathologic nomenclature. The first reported case of primary carcinoma of the ureter, with microscopic diagnosis, was that of Wiesing at Blix, recorded in 1878. Scott reported 22 different tumor types described in the literature, and Lazarus reported 15 pathologic types. Long assumes that it is more logical to limit the type of malignant tumors to two: epidermoid or solid, and papillary carcinoma.

W. W. Scott (1934) classified 61 cases. Again in 1943 he summarized 182 cases on record at that time, and presented an excellent review of the literature with a comprehensive bibliography.

Both benign and malignant tumors occur with about equal frequency in the fifth, sixth and seventh decades of life, and are seen more frequently in men than in women. The right ureter in the cases reported is involved more often than the left.

The symptoms of ureteral tumors are the same as tumors elsewhere, with hematuria being present in some of the cases. This hematuria is the earliest and most striking symptom when it occurs, and is said to be in three fourths of all cases of both the benign and malignant types. This hematuria may be intermittent, slight, or profuse, depending upon the condition of the tumor at the time. Wormlike clots may be passed from the ureter down into the bladder and voided; profuse hemorrhage is not uncommon, particularly after the traumatism caused in passing a ureteral catheter.

Pain is not constant, but is found intermittently in the majority of cases. Pain can be due to the early occlusion of the ureteral lumen by the growth, and resulting back pressure at development of hydro-nephrosis taking the form of a dull constant ache in the kidney region, and in some cases is referred to the hip and down the thigh

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Read before the seventeenth annual Postgraduate Surgical Assembly of The South-eastern Surgical Congress, Biloxi, Miss., May 23-26, 1949.

of the corresponding side. Bleeding may produce blockage of the ureter and cause acute ureteral colic. Progressive pain, as a hydronephrosis develops from the blockage, may last over a great period of time. It would have to be a very large tumor of the ureter in order for it to be palpated by either an abdominal, rectal or vaginal examination. The palpable mass recorded in most of the cases was due to a hydronephrotic kidney.

Urinalysis in these cases may show pus and red blood cells, depending upon how much drainage is coming through at the time, and before the specimen is obtained from the bladder. Centrifuged sediment may disclose atypical cells of papillomata.

Using all of our diagnostic aids, a ureteral tumor is easily overlooked. Forty-five per cent of the cases have one or more of enumerated symptoms present for one to two years before a diagnosis is made. Cystoscopic inspection of the bladder may give valuable information. Especially is this so when blood can be seen coming into the bladder from the ureteral orifice, or as in our case when we find a portion of the tumor protruding through the ureteral orifice. Secondary implants close to the ureteral orifice suggest the presence of a primary tumor further up.

Ureteral catheterization is of great assistance and, if the tumor has obstructed the ureter, the ascent of the catheter stops at the tumor. Persistent, profuse bleeding, after the catheter has met an obstruction in the ureter, should lead one to suspect a ureteral neoplasm if the roentgenographic findings are more or less negative.

Ureterograms cannot always be carried out, and are not sufficiently characteristic to enable one to make a diagnosis of ureteral neoplasm by this means alone. If we are suspicious of a neoplasm, oblique and lateral ureterograms will aid materially in reaching a conclusion as to the diagnosis. If ureterogram and pyelogram can be made above the obstructing point in the ureter, and there is no filling defect in the hydronephrosis present, or in the hydroureter above the obstructed point, we can assume the presence of a ureteral tumor. If we are dealing with a tumor in the ureter, whether it is malignant or not, its presence alone, in most cases, will eventually cause hydronephrosis with destruction of the kidney.

Our treatment is influenced by the condition of the opposite kidney. If it is not functionally capable of carrying on alone, ureterectomy with performance of a permanent nephrostomy is probably the wisest choice. Deep x-ray and radium therapy have been tried in a very few cases, but thus far have proved of little value.

The choice of operation depends upon the location and extent of the tumor, and the condition of the patient. If the tumor is small



and situated close to the bladder, and if the possibility of implants to other portions of the duct can be definitely ruled out, and we believe the kidney is worth saving, the involved portion of the ureter may sometimes be resected, and the remaining segment reimplanted into the bladder wall. Such a case was reported by McClelland. This is ultraconservative, and to our minds will have few followers. Most cases have progressed so far that ureterectomy with complete nephrectomy is the operation of choice, offering the only certain means of removal. The patient's general condition must be weighed, as well as the surgical procedure to be pursued, and how much surgery is to be done at a time.

Long brings out the following points in analyzing a total of 201 cases:

1. *History*: The first reported case was by Rayer in 1841. The first correct preoperative diagnosis was made by Albarran in 1902.

2. *Sex*: The condition is twice as frequent in male as in female patients.

3. *Age*: More than half the cases occur in the sixth and seventh decades of life. The youngest was 22, and the oldest 89 years of age.

4. *Location*: The right ureter is affected about twice as often as the left. The lower third of the ureter is the site of the growth twice as frequently as the upper two thirds.

5. *Symptoms*: Characteristic triad:

A. Hematuria, in 70 per cent; may be profuse or microscopic, early or late, recurrent or constant. Ureteral blood clots may be passed.

B. Pain, in 64 per cent; due to (a) ureteral obstruction from tumor, or blood clot; or (b) involvement of nearby or remote organs by metastases or extension.

C. Tumor, in 40 per cent; due to (a) enlarged kidney secondary to obstruction by tumor; (b) ureteral tumor felt abdominally, rectally or vaginally; or (c) enlarged lymph nodes.

6. *Urine*: May be grossly bloody or clear, even microscopically. May contain tumor cells.

7. Cystoscopy may reveal:

A. Tumor projecting from ureteral orifice in about 25 per cent of the cases.

B. Bulge in ureteral ridge.

C. Edema and congestion of ureteral orifice.

D. Trickle of blood from orifice after vaginal or rectal manipulation.

E. Obstruction, either complete, or a mushy resiliency on attempted passage of catheter.

F. Decrease in function on involved side.

8. Roentgenographic studies may reveal:

A. Hydronephrosis on affected side.

B. Goblet-shaped filling defect in region of tumor.

C. Metastases in bones or chest.

9. *Treatment*: Treatment of choice is extraperitoneal nephroureterectomy with or without segmental resection of the bladder. If necessary to do operation in two stages, remove tumor at first operation. Be certain tumor is malignant (frozen section if in doubt) before radical resection is done. Preoperative and postoperative radiation probably of little value.

10. *Pathology*: There is great confusion over nomenclature but probably 60 per cent of the tumors are papillary and 40 per cent are solid carcinomas.

11. *Metastases*: 34 per cent. Most frequent sites are retroperitoneal lymph nodes, liver, bones, and lungs.

12. *Results*: Confusing because of inadequate follow-up.

A. Postoperative deaths, about 25 per cent.

B. No patient living more than 4 years postoperatively died of metastases.

C. Of 40 patients reported well, only 14 were followed 4 or more years. One patient was well at 13 years; one, 11; one, 9; two, 8; two, 7, and one, 6 years after operation.

13. *Follow-up*: The patient should be examined every 3 months the first year after operation, every 6 months the second, third and fourth years, and yearly thereafter. The examination should consist of a general physical examination, pelvic or rectal examination, cystoscopic examination, and x-ray of lumbar spine and pelvis.

#### CASE REPORT

The interesting point in this case is that at the age of 55, after she had been married 22 years, she entered Providence Hospital in the service of Dr. John M. Wilson, for a lump and hardness in the left breast, accompanied by pain and soreness in shoulder and left arm. On Jan. 4, 1923, the tumor itself was removed for biopsy, and carcinoma was found. On January 13, Dr. Wilson removed the breast and dissected out the axillary glands; she made an uneventful recovery, and left the hospital January 25. This patient remained well after breast surgery, until the infirmities of age began their encroachment. When she was referred to us June 4, 1948, she was 79 years of age, and presented symptoms which suggested involvement of the left upper urinary tract; pain was referred to the left kidney and down the left leg. General malaise was present, and she seemed to be in distress most of the time.

*Cystoscopic Examination*: While inspecting the bladder wall a reddish tumor-like mass was seen exuding from the left ureteral orifice. Biopsy was attempted with a rongeur, but was unsuccessful as the tumor retracted or

pushed up the ureter; likewise catheterization of the ureter was unsuccessful; the catheter ascending the ureter for only 4 cm., no hemorrhage was noticed coming from the ureter after catheterization. Attempts at retrograde pyelography and ureterograms were futile. All of the glowing achievements which we have read in the literature, and listened to at medical meetings, of the successful accomplishing of the above passed in review, only to mock and jeer at us. Intravenous pyelogram showed a good functioning right kidney, with no left side findings whatever. We believed that the lower ureter was involved, and had no proof of the location of the primary tumor, other than it was in the urinary tract (left upper).

At operation the kidney pelvis was external and dilated grade II, the ureter was 1.5 cm. in diameter; no constriction at the ureteral pelvic junction was noted. The tumor mass was palpable just above the iliac vessels, there was a large gland 3 by 2 cm. medial to the ureter, and adjacent to the abdominal aorta just above the tumor mass. The ureter below the tumor appeared normal, ligation of the ureter was made just above the intramural portion of the ureter, and it was severed and removed together with the kidney using the usual technic.

*Pathological Report:* Gross description: The ureter measures 18 cm. in length. The surface is smooth. Seven cm. from the distal end is a firm indurated mass. On section, there is hemorrhage into the mucosa. The tissue is firm and white. The lymph gland measures 4 cm. in diameter. On section the normal architecture is destroyed and the tissue is white and indurated. The kidney shows dilatation of the pelvis. The calyces are blunted. Kidney tissue is thinner than usual.

*Microscopic Section:* The section of the ureter above shows dense fibrous structure, containing small groups of irregular masses of epithelial cells. These appear to be squamous in origin. The nuclei vary in size. Many are compact and rounded. There is very little attempt at differentiating stratified squamous epithelium. The section of the gland shows widespread metastatic infiltration of atypical cells. The nuclei are large and irregular. The nucleoli are prominent. There are occasional mitotic figures found.

*Diagnosis:* Epidermoid carcinoma of ureter with local lymph-node metastases.

*X-Ray of Chest:* The heart is not enlarged, ascending aorta is a little prominent, arteriosclerotic aortic knob, increased fibrous bronchial markings, some peribronchial markings, the diaphragms are clear, there are no changes in the lungs or ribs indicative of metastases.

*Remarks:* This gives appearance of senile chest without evidence of metastases.



WALTER GOODLOE STUCK, M.D.

# The Southern Surgeon

*Published Monthly by*

*The SOUTHERN SURGEON PUBLISHING COMPANY*

701 Hurt Building

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Subscription in the United States, \$8.00

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Volume XVI

May, 1950

Number 5

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## WALTER GOODLOE STUCK 1905-1950

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Some fifteen years ago two San Antonio orthopedists wondered why, no matter how tightly they fixed a fracture with a metal plate and screws, the screws soon worked loose. Was it an electrolytic process? They decided to investigate the problem, using dogs in their experiments. They were not supported by large grants; they did not work in pluperfectly equipped laboratories. Indeed, much of the work was done on the ranch of the older surgeon, and his wife was annoyed more than once to find in her frigidaire neatly wrapped up in brown paper—dog legs.

A dog in the series lost weight, sickened and died. There had been no sepsis. Autopsy revealed a bright blue liver: It did not take long to determine that this color indicated chromium poisoning. Certainly he had not been fed any chromium. But the metal plates and the screws that had fastened them in his forelegs had been made of stainless steel, an alloy rich in chromium. It had been suggested years before that electrolytic reactions had destroyed bone, but this observation was the first real substantiation.

In December, 1936, Dr. Charles S. Venable and Dr. Walter G. Stuck were able to present before the Southern Surgical Association proof that electrolysis destroyed the bone around plates and screws commonly used in the fixation of fractures at that time, but that the new alloy vitallium was inert.

Walter Stuck was born January 19, 1905, in Jonesboro, Arkansas. After attending Hendricks College and receiving a bachelor's degree at Emory University, he was graduated at Washington University in medicine (1929). A year's internship at the University of Michigan Hospital was followed by four years at the Mayo Clinic, winding up with the Minnesota degree of Master of Science in Orthopedic Surgery.

Dr. Stuck moved to San Antonio in 1934 to practice orthopedic surgery. He loved the city of his adoption. He was to serve as a director of the Community Chest. He helped organize the Polio Treatment Center during the epidemic of 1942. He held membership in the Methodist Church and several social clubs.

In addition to Phi Sigma, Sigma Chi, Kappa Alpha and Nu Sigma Nu fraternities, Dr. Stuck also belonged to the Southern Surgical Association, the American College of Surgeons, the American Academy of Orthopedic Surgeons, the American Orthopedic Association, the Clinical Orthopedic Society, his County Medical Society and other professional organizations. He was President of the Texas Surgical Society in 1947; and he was Professor of Orthopedic Surgery at Baylor Graduate School of Medicine.

Barred from World War I by his youth and from World War II by his health, Dr. Stuck was Civilian Consultant for the Army's Brooke Medical Center in San Antonio. He was also Attending Orthopedic Surgeon at the Medical and Surgical Memorial, the Nix and Santa Rosa Hospitals, and Chief of Orthopedic Surgery at the Robert P. Green Hospital.

Dr. Stuck appeared several times on the programs of The Southeastern Surgical Congress and was for ten years Associate Editor of *THE SOUTHERN SURGEON*. It was largely through his untiring efforts that the Southwestern Surgical Congress was organized in 1948; he became its first President and later a member of its Council. At the meeting of The Southeastern Surgical Congress in Washington in March, 1950, he was elected an Honorary Fellow of that organization.

Acute leukemia cut short his career on March 21, 1950.

In addition to his book, Dr. Stuck contributed more than 75 papers to medical journals of the country. Most of these portrayed



the inquiring mind of a scientist and the dexterity of a skilful surgeon; others showed rather the cultured interests of a medical historian. But those who knew him best will treasure his memory not so much for his professional achievements as for the charm of his personality, the warmth of his friendship and the sincerity of his character.

L. MINOR BLACKFORD, M.D.

## BOOK REVIEWS

*The Editors of THE SOUTHERN SURGEON will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted without solicitation.*

CURRENT THERAPY 1950. Howard F. Kahn, M.D., Editor. Philadelphia and London: W. B. Saunders Co., 1950.

This is the second in a series of volumes and continues the purpose of bringing to the practicing physician authoritative information on the latest approved treatment for disease. There are more than 250 contributors represented, each is fairly well-known as an expert in the disease about which he is writing. The book is designed to be complete in itself and to contain all of the information that the busy physician needs in order to treat the disease manifestations which confront him. In many instances, two or even more methods of treating a single disorder have been included. For the most part, these methods are well outlined, easily understandable and well founded.

The book is divided into fifteen sections. The index is very thorough.

The first section includes the infectious diseases and it is interesting to note that under the "common cold," to show how up to date this volume is, Dr. Kneeland states, "It has been alleged that antihistaminic drugs, given in the first few hours of a cold, abort a high percentage of cases. Confirmation of this is lacking and it is our experience that patients rarely seek medical advice so early in the disease." Dr. Loosli, in talking about the common cold says, among other things, "Antihistamine drugs, when given early in the course of a cold, are said to avoid the attack. Well controlled studies have been reported to substantiate these claims."

The second section is Diseases of the Respiratory System. In general this section is very good but we would like to differ with Dr. Scherf in his treatment of pulmonary embolism in that he feels that ligation of the vein containing the phlebothrombosis should be used, if for some reason heparin and dicumerol therapy are contraindicated; whereas we believe that it is common opinion that ligation should be used much more extensively and in particular in patients having multiple emboli. It is gratifying, however, to note that under carcinoma of the lung, "In the presence of an uncertain diagnosis, early exploration should be done. Thoracic exploration should be utilized as readily as abdominal exploration for suspected tumor, since the mortality and morbidity of the two are comparable. As a final reminder, we want to emphasize strongly that in this age of mass chest surveys by x-ray, an asymptomatic pulmonary mass should be considered as carcinoma of the lung until proved otherwise." The cardiovascular disease section is very complete.

Section four, discussing the diseases of the blood stream, seems to be complete with such men as Roy Kracke and Maxwell Winthrobe contributing considerable of the writing.

Section five, Disease of the Digestive System, is very good. It is interesting to note that all three authors on chronic appendicitis, Warren Cole, Clarence Dennis and Keith Grimson, agree that there is no such thing as chronic appendicitis. Dr. Grimson states, "With the exception of patients having recurring episodes of mesentery lymphangitis, or patients who have appendicitis treated conservatively, removal of an appendix not acutely inflamed seldom relieves symptoms." Dr. J. A. Bargen, in speaking of the treatment of ulcerative colitis, states, "It has become obvious that when a patient has reached the

stage at which ileostomy is advisable, colectomy should follow ileostomy as soon as the patient's condition may warrant." We are a little disturbed to see that Dr. George Pack, in speaking of carcinoma of the stomach, has not followed the beliefs of many other surgeons and still advocates, "The majority of cancers of the stomach should be excised by removal of a portion of the stomach," rather than total gastrectomies as are now being advocated and which seem to us to be the only way that we are going to improve the statistics on the death rates of carcinoma of the stomach.

Section six on the disorders of metabolism and nutrition is quite thorough. In speaking of hyperthyroidism, we must disagree with Dr. McGavack in that he states, "Should medication with anti-thyroid compounds be followed by second recurrences, or should a severe toxic reaction occur in connection with this therapy, then the patient should receive the benefit of radiation or surgery." It should be pointed out here that the vast majority of the members of the American Goiter Association still believe, and even more firmly this year than in previous years, that the treatment of hyperthyroidism is surgical after the patient has been prepared with anti-thyroid drugs. We do agree with him when he says, "Radiation therapy has usually been reserved for the subject on whom surgery is contraindicated."

Section eight on the urinogenital tract is very good, the section on renal failure being particularly well done.

Section nine, Venereal Disease, ten, Allergy, and eleven, Dermatology are very good and section twelve, on the Nervous System, is quite complete.

This seems to be a very good volume for the busy practitioner, and while far from complete, it seems to lead one in the right direction.

A. H. LETTON, M.D.

## ABSTRACTS FROM CURRENT LITERATURE

FRACTURE OF RIBS—A LOGICAL TREATMENT. F. P. Coleman and L. Coleman, Surg., Gynec. & Obst. 90:129-134 (Feb.) 1950.

Careful study reveals that 10 to 20 per cent of patients with fractured ribs associated with lung or pleural complications die as a result of their injuries. This refutes the popular notion that fractures of the ribs are unimportant and insignificant. Three hundred and forty-seven patients were admitted to the Medical College of Virginia Hospital from January, 1940, to July, 1948. There were pleural, lung or cardiac complications in 149 cases. Of these 41 died of their injuries and in 28 patients (19 per cent) the cause of death was related primarily to the lung.

Except for novocain block of the intercostal nerves to relieve pain, no progress has been made in the treatment of fractured ribs since Malgaigne described his method in 1859. The authors present a discussion of the treatment of these injuries, including establishment of a clear airway, decompression of tamponade, the management of emphysema, etc. They feel that simple uncomplicated fractures have little indication for treatment other than nerve block therapy, but more severe and complicated injuries require a more logical and direct attack to relieve pain, stabilize the chest wall, correct deranged physiology and prevent complications. They feel that modern developments of good anesthesia and antibiotics have rendered the wiring of rib fractures a safe and logical solution to the problem.

"Severe pain, paradoxical motion of the chest wall, instability of the fracture fragments of the lower six true ribs, or certain pleural and lung complications are imperative indications for internal fixation of fractured ribs by wire. Stable and sturdy fixation of transverse or oblique rib fractures can be attained by fixing the fracture fragments with wire or with wire and a bone peg."

The authors have employed the method in 15 cases and feel that the results have been very satisfactory. They feel that the method deserves broader application.

SUBACUTE THYROIDITIS. G. Crile, Jr., and E. W. Rumsey, J.A.M.A. 142:458-462 (Feb. 18) 1950.

This entity (not to be confused with Reidel's struma or Hashimoto's disease) which the author defines as "an acute or chronic self-limited inflammation of the thyroid gland, which is probably initiated by a virus infection and prolonged by a granulomatous reaction to displaced or perverted colloid," has been given many other titles such as pseudotuberculous thyroiditis, struma granulomatosa, etc. The clinical course is variable but two rough categories can be recognized: "(1) the acute fulminating type with fever, pain, exquisite tenderness and severe systemic symptoms; and (2) the chronic type, with little if any fever, slight pain, slight tenderness and insignificant systemic symptoms." These two types seem to be the same pathologic entity and respond to therapy in an identical manner. Between the two extremes, there are cases with all degrees of variation.

This relatively rare disease occurs most commonly in the 30 to 50 year age group. It occurs predominantly in females. The increased frequency with which the diagnosis has been made in recent years may be due to an increased awareness rather than a true increase in incidence.

The diagnosis is predicated on the finding of a firm tender thyroid gland. If the entire gland or one whole lobe is uniformly involved, the diagnosis is usually clear. In the chronic phase and when the gland is irregularly involved, the diagnosis may be more difficult. The sedimentation rate is consistently and greatly elevated. An involved gland will take up little or no radioactive thyroid. The white blood count is not elevated and the basal metabolic rate is not materially altered.

The microscopic pathology is characterized by foreign body reaction, fibrosific degeneration and exudation. Positive diagnosis may be made by needle biopsy.

For the past ten years, roentgen therapy has been employed at the Cleveland Clinic for the treatment of this condition with uniformly good results. The dosage usually is small (600 to 800 r). Two cases were treated by thyroidectomy because the true nature of the disease was not recognized preoperatively. The authors feel that thyroidectomy is not necessary.

#### ADVANTAGES OF THE RIGHT LATERAL DECUBITUS IN CHOLECYSTOGRAPHY.

B. R. Kirlin, *Texas State J. Med.* 46:5-8 (Jan.) 1950.

"Of all impediments to satisfactory roentgenography, obscuration of the gallbladder by other organs or their contents, particularly by gas in the bowel, has been perhaps the most difficult to overcome, an occurrence which probably accounts largely for the well known fact that more than 10 per cent of cholecystographically normal gallbladders have been found to contain gallstones which were not visible on the cholecystograms." Clearing enemas, injections or pitressin, etc., have been employed to remove obscuring gas collection. The author feels that the most feasible approach to the problem is through changing the position of the patient. Apparatus was improvised for the use of the right lateral decubitus position. It was found that in almost every instance, the gallbladder fell toward the patient's right side, below the obscuring gas-filled loop. Pitressin was not required in more than 0.5 per cent of the cases.

Several cholecystograms in which both the prone and lateral decubitus positions were used are reproduced for comparison.

"It is not to be inferred that this position should supersede the standard prone position commonly employed, for the latter is effective in revealing adenomas and other tumors of the gallbladder and should be used both before and after the administration of a fatty meal. Nevertheless, the right lateral decubitus should also be applied as a supplementary routine whenever the roentgenogram with the patient in the prone position reveals (1) what appears to be a normally functioning gallbladder without stones, (2) doubtful shadows or shadow defects that might represent gallstones, of (3) obscuration of the gallbladder region by intestinal gas. In any of these situations the lateral position can confidently be counted on to supply decisive information."

#### THE EFFECTS OF HEMOCONCENTRATION ON THE ULCER DIATHESIS. I. D. Baronofsky; D. State; S. R. Friesen; M. Finn, and O. H. Wangenstein, *Ann. Surg.* 131:31-43 (Jan.) 1950.

Noting the frequent association of hemoconcentration and ulceration of the gastric mucosa, the authors are reporting the results of two series of experiments dealing with the role of hemoconcentration in the formation of peptic

ulcer. Briefly considered is the possibility of a direct surgical attack on polycythemia vera.

In the first series of experiments, hemoconcentration was produced by daily plasmaphoresis and the replacement of the volume of plasma with an equal volume of cells from a compatible animal. In the second series, subcutaneous injection of hypertonic salt solution was employed to effect the hemoconcentration. A total of 32 healthy mature dogs were used.

Though they were able to demonstrate clearly that hemoconcentration does aid and abet experimental ulcer diathesis, the exact mechanism by which this effect occurs is open to discussion. It seems fairly clear that the increased viscosity of the blood is a factor and thrombosis of the end vessels may increase the susceptibility of the gastric mucosa to ulceration.

Clinically, ulcer is reported about four times more frequently in polycythemic patients than in others. On the supposition that an intrinsic hemopoietic factor may originate in the gastric mucosa, the authors conceived the idea of treating polycythemia vera by resection of a part of the stomach. A case is presented in which gastrectomy as a form of permanent therapy for polycythemia has been tried with good results thus far, two years after operation.

POSTOPERATIVE PANCREATITIS. D. Metheney and V. O. Lundmark, *North-west Med.* 48:465-466 (Nov.) 1949.

Because of their stated belief that postoperative pancreatitis is more frequent than it is ordinarily supposed to be, the authors present the report of a case of a 54 year old woman who, following a gastric resection for a pyloric ulcer penetrating into the pancreas, developed severe penetrating back pain on the fifth postoperative day. The temperature rose to 104 degrees and a serosanguineous discharge from the wound appeared. The white blood count rose to 21,000 with polymorphonuclear leukocytosis. On the tenth postoperative day, the blood amylase was reported as 700 units. Conservative measures resulted in improvement. A pancreatic fistula persisted for three weeks, at the end of which time it closed spontaneously.

The case report is preceded by a brief review of the literature on the subject.

NEWER CONCEPTS IN SURGERY OF THE PANCREAS. Charles G. Child III. *Ann. District of Columbia* 19:1-9 (Jan.) 1950.

Though the advances that have been made in the past ten to fifteen years in the surgical treatment of certain diseases of the pancreas and its surrounding structures are based on procedures proposed many years ago, their actual application has had to await recent improvements in preoperative and postoperative management such as control of hemorrhagic diathesis of jaundice with Vitamin K, employment of non-absorbable suture materials, antibiotics, better control of fluid and electrolyte balance, etc.

The most important advance has been that of bringing pancreaticoduodenal malignancies under surgical treatment through employment of radical pancreaticoduodenectomy. The reader is reminded that the jaundice accompanying these tumors may be intermittent and that preoperative differentiation between primary and obstructive jaundice is not always possible. It is emphasized that in the case of malignancies of the pancreas, jaundice is a late symp-



tom and that epigastric pain radiating to the back and which is worse at night is the most frequent presenting symptom. Rapid loss of weight associated with weakness is the most constant symptom.

In a brief discussion of the history of radical pancreaticoduodenectomy, it is pointed out that though Codvilla first performed the operation in 1898 and during the next forty years it was sporadically tried and abandoned due to the magnitude of the undertaking and the mortality rate, it remained for Whipple to revive interest in the procedure. In 1937, he advocated the procedure that has come to bear his name. The author describes a modified one-stage procedure which has been employed in some forty cases operated on since 1940 at the New York Hospital. He states that it has met with reasonable success in the hands of some six or seven surgeons. The procedure, in essence, is as follows:

Operability is determined by inspection of the portal vein area (effected by division of the right gastric artery, the lower gastrohepatic ligament and then mobilizing and reflecting the duodenum). If no metastasis is detected in these areas, it is determined whether or not the superior mesenteric vein is involved. This is approached by division of the base of the transverse mesocolon. If it be determined that the tumor is operable, the stomach and pancreas are divided in the usual manner at about the midpoint of the stomach. The dissection is carried toward the patient's right side and the superior mesenteric vein freed from the head and uncinate process of the pancreas. The resection is completed by division of the inferior pancreaticoduodenal artery, the jejunum and the structures comprising the ligament of Treitz. Continuity of the gastrointestinal tract is restored by retrocolic end-to-end pancreaticojejunostomy, end-to-side choledochojejunostomy and antecolic gastrojejunostomy.

Acute pancreatitis has received renewed attention recently. The most significant recent advance has been the recognition of the fact that in the majority of instances the process will subside without progression to the hemorrhagic or necrotic stage. Certain authorities have insisted that the Somogvi test for elevated serum amylase provides a means whereby acute edematous pancreatitis can be recognized with great accuracy. The author feels that the test has not proved reliable and at the New York Hospital it is still the practice to subject most of the patients to early operation. After a consideration of the many facets of the problem, he concludes that a program such as that suggested by Elman appears to be the most logical course to follow, that is, that in the event that the diagnosis can be established upon the basis of elevated serum amylase, operation is withheld on those who promptly show evidence of improving. In those whose clinical status fails to improve upon supportive therapy or actually deteriorates, operation should be done and adequate drainage of the areas of pancreatic necrosis established across the lesser omental sac.

In regard to the surgical treatment of chronic pancreatitis, the author feels that sympathectomy is preferable, at least for the present, to pancreatectomy as advocated by Whipple. Whether or not bilateral sympathectomy is necessary remains to be determined. He minimizes the frequently stated fear that denervation will mask an acute process which may develop at a later date. He emphasizes the importance of exploration of the pancreas prior to sympathectomy to rule out an underlying or superimposed malignancy.

Cysts of the pancreas constitute an interesting chapter in abdominal surgery. The author states a preference for simple tube drainage or marsupialization in dealing with pseudocysts and reserves anastomosis to the intestinal

tract for employment only in those instances of proliferative cysts which defy attempt at resection.

The understanding of the function, diagnosis and treatment of tumors of the islands of Langerhans represents one of the outstanding recent surgical advantages. Since Mayo successfully resected one of these tumors in 1927, over 200 case reports have appeared in the literature. Practically all of these tumors are benign. In establishing a diagnosis preoperatively, Whipple's triad of findings is essential. Less rigid diagnostic signs result in a greater instance of negative explorations.

It is emphasized that the thyroid may become overactive in hyperinsulinism. The mechanism is not clear. Every patient suspected of having one of these tumors should have his thyroid activity investigated and prepared accordingly.

R. H. S.

FIBROCYSTIC DISEASE OF THE PANCREAS. William B. Ayers, Daniel Stowens and Alton Ochsner, *J. A. M. A.* 142:7-12 (Jan.) 1950.

The authors have employed splanchnic block and right sided splanchnicectomy in the treatment of pancreatic fibrosis with spectacular immediate results. These cases together with the presentation of a theory of neuroeffector mechanisms form the basis for this report.

In each instance, the diagnosis was established by demonstration of the absence of trypsin from the duodenal contents. Fecal analysis was confirmatory and in three instances flat Vitamin A Tolerance curves were obtained.

Splanchnic blocks were performed according to the modified Kappis technic using 5 to 10 c.c. of a 1 per cent procaine hydrochloride solution, depending on the size of the child. General anesthesia with vinyl ether was necessary because of the poor cooperation of these young patients with local anesthesia alone. Splanchnicectomies were effected through a subdiaphragmatic approach. The right splanchnic nerves were excised at their entrance to the celiac ganglion, traced superiorly to their exit from the sympathetic chain and avulsed at that point.

A series of five cases is presented. Each case was first subjected to splanchnic block with observations on increase in trypsin production either by duodenal aspiration or by stool analysis. This was followed by right splanchnicectomy. One patient died during operation of cardiac arrest which, after necropsy, was deemed to be of reflex origin. This pointed up the importance of adequate preoperative atropine.

Since the immediate postoperative improvement in the pulmonary symptoms occurs too quickly to be related to increased circulation of the pancreas, the authors advance the theory that the pulmonary disease accompanying and secondary to the pancreatic disease is brought about reflexly through a neuroeffector mechanism, and that the interruption of this reflex arc produces immediate restoration of normal efferent impulse patterns to other viscera, in particular the lung. The widespread application of such an idea to explain relationships of casual relationship of disease of other organs (such as the association of gallbladder disease and heart conditions) is inferred.

R. H. S.

GIANT FIBRO-ADENOMA OF THE BREAST . . . "CYSTOSARCOMA PHYLLODES."  
John R. McDonald and S. W. Harrington, *Ann. Surg.* 131:243-251 (Feb.) 1950.

"Giant fibro-adenoma of the breast can be defined as a fibro-adenoma of large size that involves much of the breast." The authors consider the term "cystosarcoma phyllodes" which is usually applied to this type of tumor to be misleading since the great majority of such tumors are benign. Many other terms are encountered in the literature but giant fibro-adenoma would seem to be the most satisfactory. It is preferable to include under this heading only those which are benign.

Records were found of 13 patients with this type of tumefaction seen at the Mayo Clinic from 1904 to 1943. Two other cases were excluded because malignant change was noted in the stroma cells of the fibro-adenoma. In order to be included in this series, the fibro-adenoma had to involve more than four-fifths of the breast and weigh more than 500 grams.

Four patients had bilateral giant fibro-adenomata. Two of these were adolescent girls, one had not begun to menstruate, and the remaining case had first noted the enlargement during a pregnancy five years before. In these cases simple mastectomy was either performed in one stage or with a short interval (about one week) between the operative procedures on the two sides. In one other case, unilateral simple mastectomy was followed by simple mastectomy of the opposite side six years later for chronic mastitis without adenoma. The remaining cases were treated with simple mastectomy.

Aside from the immense size, weight and diffuseness, these tumors differ little in gross appearance from a smaller fibro-adenoma. Actual cyst formation was not common in this series. The microscopic appearance was similar to that of smaller fibro-adenoma except that myxomatous degeneration of the stromal cells is a fairly constant finding. In practically every case there was a mixture of intracanalicular and pericanalicular types of fibrous tissue proliferation.

The authors emphasize that while the majority of these tumors are benign (about 90 per cent), is is potentially malignant and must be considered so until proved otherwise. Simple mastectomy is the treatment of choice in the benign lesions because of the extent of involvement and the malignant potentialities.

R. H. S

SECTIONAL MEETING OF THE SOUTHEASTERN SURGICAL  
CONGRESS, GREENBRIER HOTEL, WHITE SULPHUR  
SPRINGS, W. VA., JULY 13, 14, 15, 1950

The program for the annual convention of the Maryland, District of Columbia, Virginia and West Virginia sections of the Southeastern Surgical Congress is about complete, and among essayists on the program are Drs. J. M. Emmett, Clifton Forge, Virginia; M. L. White, Jr., Huntington, W. Va.; Herbert Schoenfeld, District of Columbia; Amos R. Koontz, Baltimore, Maryland; and C. C. Howard of Glasgow, Kentucky, president of the Congress.

In addition, Dr. W. Raymond McKenzie, chairman of the Maryland section, will present a paper on "Nasal Fractures." Dr. McKenzie is also scheduled to preside at one of the scientific sessions, while Drs. Waverly R. Payne of Newport News, Va., Everett Lyle Gage of Bluefield, W. Va., and Harry Lee Claud of Washington, D. C., chairmen of their respective sections, will also preside at scientific sessions.

Principal address of the meeting will be delivered at the banquet on Saturday evening, July 15th, by Hon. Rush D. Holt, former United States Senator from West Virginia. His subject will be "The Fable of the Free Lunch." Toastmaster at the banquet will be Hon. C. W. Strickling, of Huntington, W. Va., prominent attorney.

Reservations should be made direct with the Greenbrier Hotel, White Sulphur Springs, W. Va., it was stated. An attendance of between 125 and 150 is expected at the meeting.

During the three-day meeting, each state will have separate meetings for the purpose of transacting any state business that might be brought up. A golf tournament will take place, and prizes will be awarded at the banquet. All physicians, whether members of the Congress or not, are invited to attend the sessions. Each of the three scientific sessions is to be held from 10 o'clock A.M., until 1 o'clock P.M., thereby affording ample opportunity for recreation, including golf, tennis, swimming, horseback riding, etc.

